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Journal Contents

From the Editor's Desk

The Spring 2023 edition of the *Journal of Psychological Inquiry* features some exciting research. This semester, the Elizabeth A. Dahl Award for Excellence in Undergraduate Research went to an extremely well written article by Brennan, Rutledge, and Faulkenberry. Utilizing Bayesian analysis, the authors challenge some of the traditional usage of hypothesis testing in statistical analysis.

Other exciting research in this edition includes interdisciplinary explorations of psychology, criminology, literature, and personality analysis. With that having been said, this edition contains a combination of traditional psychological research while also pushing boundaries.

It was an honor to once again copyedit for this issue, and I will always be grateful to my mentor and friend, Dr. Ken Sobel, for giving me this opportunity. I have thoroughly enjoyed reading through the research that upcoming experts in the field have been working on, and I know that the future holds even greater things.

Tristan Brass

Tristan Brass
Graduate Assistant
University of Central Arkansas

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Elizabeth A. Dahl, Ph.D., Award for Excellence in Undergraduate Research

ARITHMETIC OPERATION SIGNS ELICIT SPATIAL ASSOCIATIONS: A CONFIRMATORY BAYESIAN ANALYSIS

KEELYN BRENNAN, MICHAELA RUTLEDGE, & THOMAS J. FAULKENBERRY

TARLETON STATE UNIVERSITY

Abstract – Previous research in numerical cognition has indicated that people form mental associations between numbers and space. The purpose of the present study was to replicate and confirm an operation sign spatial association originally reported by Pinhas, Shaki, and Fischer (2014). In our study, participants were asked to make a speeded classification of the arithmetic operation (addition or subtraction) that was represented by two mathematical operation signs (+ or -). A Bayesian analysis confirmed that response times increased in the condition where response codes were incongruent with an "addition = right side of space / subtraction = left side of space" mapping. These results confirm those originally reported by Pinhas et al. (2014) and indicate that people may form an association between arithmetic signs and spatial location. Further, we demonstrate how to perform a confirmatory Bayesian analysis in the free software package JASP, including the use of sensitivity analysis and informed priors. In addition to explaining how spatial-operational associations are a potentially fruitful line of inquiry in numerical cognition, the present work provides a concise demonstration of how to conduct a confirmatory Bayesian analysis.

Keywords: operation signs, spatial association, Bayes factor, informed priors, JASP

Research in numerical cognition is primarily concerned with questions about how numbers are represented in the mind and brain. Much previous research in this field has indicated that people form spontaneous mental associations between numbers and space (Faulkenberry, 2016; Fischer & Shaki, 2014; Marghetis, Núñez, & Bergen, 2014). The purpose of the present study is to investigate one such association – a spatial association with arithmetic operation signs (Pinhas et al., 2014) – and perform a confirmatory Bayesian analysis of the observed data.

These spatial-numerical associations typically appear in the form of increased response times (RTs) on experimental trials with stimuli that are in an opposite configuration to the proposed association. For example, consider a task where people are asked to classify the parity (i.e., even or odd) of presented number digits. In one half of the experimental trials, participants indicate even digits with a left hand button press and odd digits with a right hand button press. In the other half, these instructions are switched, thus ensuring that every number digit is responded to with both hands throughout the course of the experiment. Even though a judgment of number magnitude (i.e., small, large) is not required for the task, number magnitude seems to interact with response hand. That is, people are faster to respond to small numbers with the left hand and large numbers with the right hand. This phenomenon is called the SNARC effect (Dehaene, Bossini, & Giraux, 1993; Dehaene, Dupoux, & Mehler, 1990), where SNARC is an acronym for Spatial-Numerical Associations of Response Codes. Because RTs are longer when response codes are opposite the typical "left = small, right = large" orientation of the physical number line, these data are widely thought to represent a left-to-right spatial ordering of the mental number line.

Remarkably, this left-to-right spatial association with numbers has been found in mental arithmetic as well. McCrink, Dehaene, and Dehaene-Lambertz (2007) had participants perform a nonsymbolic arithmetic task. For addition problems, two dot patterns moved behind a blocking screen; one traveled from the left side of the screen and one traveled from the right side of the screen. Afterward, the screen was removed and participants were asked to judge whether the number of dots revealed was the correct outcome. Subtraction problems were

performed similarly; at first a dot pattern traveled from the left to move behind the screen, then a subset of dots continued the implied trajectory and moved away to the right (effectively "taking away" from the original dot collection). Again, the screen was removed, and participants were asked to judge the correctness of the remaining dot pattern. Error patterns on this task indicated that participants overestimated their answers to addition problems, whereas subtraction problems led to underestimation. McCrink et al. (2007) interpreted these error patterns as an operational momentum effect, reflecting an "overshooting" of the correct answer as participants scanned along the mental number line (rightward for addition, leftward for subtraction).

Though one might argue that this operational momentum is an artifact of the nonsymbolic arithmetic task that McCrink et al. (2007) used, similar results appear even in symbolic tasks involving just an operation sign. For example, Pinhas et al. (2014) had participants perform a simple operation sign classification task, identifying whether a presented operation sign (+ or -) represented the operation of addition or subtraction, respectively. On half of the trials, participants responded "addition" with a right-hand button press, and "subtraction" with a left-hand button press. On the other half of trials, this response mapping was reversed. Pinhas et al. (2014) discovered that people are faster to classify the "+" sign in the "addition = right hand" condition, and similarly, faster to classify the "-" sign in the "subtraction = left hand" condition. Because RTs were increased in the condition where response codes were opposite (i.e., incongruent) with an "addition = right side of space / subtraction = left side of space" mapping, Pinhas et al. (2014) interpreted these data as reflecting an inherent spatial-arithmetical association and coined the association as the OSSA effect (operation sign spatial association).

The Pinhas et al. (2014) result is truly remarkable, as it indicates that spatial-arithmetical associations exist at a fundamental level. Indeed, it seems that the presence of a lone addition sign can promote a rightward spatial momentum. Thus, these data seem to indicate that people possess an inherent spatial association with the operation sign itself, and the context of actually performing mental arithmetic is not even necessary to evoke the effect. To our knowledge, the OSSA effect of Pinhas et al. has not been independently replicated. Replication is necessary in order to justify any claims of spatial-arithmetical association, as such claims have become a fundamental component in the recent literature on the nature of mental arithmetic (Azhar, Chen, & Campbell, 2020; Chen & Campbell, 2017; Thevenot & Barrouillet, 2020).

In the present study, we attempted to replicate the OSSA effect of Pinhas et al. (2014). Additionally, we performed a fully confirmatory Bayesian analysis of the resulting data (Faulkenberry, Ly, & Wagenmakers, 2020). In a Bayesian analysis, we are able to mathematically specify competing hypotheses about the effect sizes we expected to observe in our experiment and then measure the relative predictive performance of each hypothesis (i.e., the evidence for each hypothesis). This evidence is quantified with a Bayes factor (Faulkenberry, 2022; Kass & Raftery, 1995; Wagenmakers, 2007), which measures the extent to which the observed data are more likely under one hypothesis compared to the other. This approach is growing in popularity in the psychological sciences, both for its conceptual simplicity and for its pragmatic solution to the problems inherent in traditional hypothesis testing with p-values (Wagenmakers, 2007). With Bayesian analysis, there is no need to choose between hypothesis testing and estimation (i.e., Cumming & Calin-Jageman, 2016). Since both are integrated into the same analysis, we can first assess the evidence for (or against) the OSSA effect, and *if* we find positive evidence for the effect, we can *then* estimate the size of the effect and quantify the uncertainty of this estimate. Additionally, the Bayesian approach gives us the ability to test the robustness of our claims against different prior settings as well as track the impact of collecting additional subjects on accumulated evidence.

Method

Participants

We tested 35 participants (28 female, mean age = 22.8 years, age range 19 to 61 years) on an operation sign classification task. All 35 participants were students at Tarleton State University who participated in exchange for partial course credit in an introductory level psychology course.

Design and procedure

Participants began the experimental session by sitting approximately 60 cm in front of a computer. After signing a consent form and completing a brief demographic questionnaire, each participant then completed an operation sign classification task. The task was programmed and deployed using SuperLab 5.0 software on a 20-inch iMac desktop computer with a screen resolution of 1280 x 1040 pixels. Participant input was captured using a Cedrus Corporation RB-730 response pad.

During the task, the arithmetic operation signs "+" and "-" were presented as stimuli. Participants were asked to classify each presented operation sign as representing either addition or subtraction. These stimuli were presented in 60-point Courier font in black on a gray background (RGB color values red = 153, green = 153, blue = 153). Participants were instructed to keep their left and right index fingers on the leftmost and rightmost buttons (respectively) of the response pad. Once a brief instruction page was read, the participant initiated the first of the experimental trials with a button press. Each trial began with a blank screen presented for 750 ms, followed by a randomly selected operation sign (+ or -) that remained on the center of the screen until a response was made. The computer displayed a red "X" after an error, and no feedback was given for correct responses.

Participants completed the task under two counterbalanced response rules. On half of the trials, participants were asked to respond "addition" with a right-hand button press and "subtraction" with a left-hand button press (congruent response rule). On the other half of the trials, this response rule was reversed (incongruent response rule). Eighteen participants began with the congruent response rule, whereas 17 began with the incongruent response rule. Each sign was presented 14 times in random order for a total of 28 repetitions per response rule. The response rule was switched after the completion of these 28 trials and the procedure was repeated for the other response rule. In all, each participant completed a total of 56 trials of the operation sign classification task.

Results

Data Preparation

Across all participants, we observed a total of 1,960 experimental trials. We removed 87 error trials (4.4% error rate), as well as 12 trials (0.64% of remaining trials) for which RT was less than 200 ms or greater than 2000 ms. Each trial was then classified as either congruent or incongruent according to response rule. Congruent trials were those on which either the addition sign was responded to with the right hand or the subtraction sign was responded to with the left hand. All other trials were classified as incongruent. The remaining RTs were collapsed (via the mean) into 70 design cells, obtained by crossing the factors of participant ($N = 35$) and condition (congruent, incongruent).

Bayesian Hypothesis Testing

We chose to analyze our data with the default Bayesian t-test (Faulkenberry, 2019a; Rouder, Speckman, Sun, Morey, & Iverson, 2009). The Bayesian t-test works by first specifying two competing hypotheses about the population-level effect size δ. This effect size reflects the standardized mean difference in RTs between congruent and incongruent trials. Since past studies indicate that RT should increase on incongruent trials, we too expected to find $\delta > 0$. Thus, we formally defined our two competing hypotheses to test this expectation. The null hypothesis was defined as an effect size of 0, denoted $\mathcal{H}_0: \delta = 0$, and the alternative hypothesis was defined to be a positive effect, denoted $\mathcal{H}_+: \delta > 0$.

To perform a Bayesian analysis, we must assign two types of prior belief before observing data: (1) the prior *model* probabilities of the two hypotheses $\mathcal{H}_0$ and $\mathcal{H}_+$; and (2) the prior distribution of effect sizes δ that we expect under $\mathcal{H}_+$. We used default specifications for both. To define the prior model probabilities, we set the prior probability of each hypothesis to $p(\mathcal{H}_0) = p(\mathcal{H}_+) = 0.50$, giving us 1-to-1 prior odds and indicating no *a priori* preference for either hypothesis before observing data. Second, we set the prior distribution on δ as a positive half-Cauchy distribution with scale $1/\sqrt{2} = 0.707$ (see the left panel of Figure 1). This prior scale setting means that before observing any data, we expect with probability 1/2 that the latent population-level effect size δ should have magnitude less than 0.707. The number 0.707 (called the *scale* of the Cauchy distribution) is chosen because the resulting prior on δ has a number of desirable mathematical properties (Rouder et al., 2009).

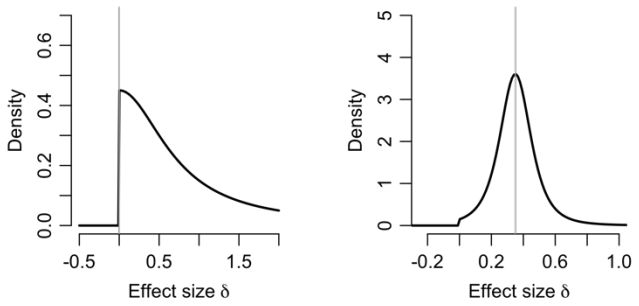

Figure 1
Prior distributions for δ under $\mathcal{H}_+$. The left panel depicts the default prior, defined as a positive half-Cauchy distribution with scale $1/\sqrt{2}$. The right panel depicts the informed Oosterwijk prior, defined as a scaled noncentral t-distribution with center 0.35, scale 0.102, and $df = 3$.

Model comparison was then performed using the Bayes factor (Faulkenberry, 2022; Kass & Raftery, 1995), which indexes the relative likelihood of observing our data under $\mathcal{H}_0$ and $\mathcal{H}_+$. For example, $\text{BF}_{+0} = 9$ would

mean that our observed data are 9 times more likely under $\mathcal{H}_+$ than $\mathcal{H}_0$; this would show positive evidence for $\mathcal{H}_+$. On the other hand, $\text{BF}_{+0} = 1/9$ would mean that $\text{BF}_{0+} = 1/\text{BF}_{+0} = 1/(1/9) = 9$, indicating that the data is 9 times more likely under $\mathcal{H}_0$ than $\mathcal{H}_+$, thus providing positive evidence for $\mathcal{H}_0$. Bayes factors were then converted to posterior model probabilities for $\mathcal{H}_0$ and $\mathcal{H}_+$ (Faulkenberry, 2019b; Masson, 2011) using the following equation:

$$p(\mathcal{H}_+ \mid \text{data}) = \frac{\text{BF}_{+0}}{1 + \text{BF}_{+0}}.$$

These posterior model probabilities give us another easy-to-interpret index of model preference. The hypothesis with posterior probability greater than 0.50 is the preferred model, and the closer the posterior probability is to 1, the greater our preference for that model. All Bayes factors reported below were computed using the free software package JASP (Faulkenberry et al., 2020; JASP Team, 2020), which can be freely downloaded from https://www.jasp-stats.org.

Response Time Analysis

Mean response times for each experimental condition can be seen in Figure 2. As is immediately clear, responses on congruent trials were faster than responses on incongruent trials. When the presented stimulus was a plus sign ("+"), responses with the right hand were faster (M = 439 ms) than responses with the left hand (M = 483 ms). When the presented stimulus was a minus sign ("-"), the pattern was opposite – responses with the left hand were faster (M = 446 ms) than responses with the right hand (M = 474 ms). In both cases, the means reflect the operation sign spatial association (OSSA) of (Pinhas et al., 2014). We will now assess the evidence for this effect with a Bayesian t-test.

Bayesian *t*-test

As a first step for the Bayesian t-test, we computed a difference score for each participant, defined by subtracting the mean response time for congruent trials from the mean response time for incongruent trials. We then performed a Bayesian t-test on these difference scores, giving a Bayes factor of $\text{BF}_{+0} = 10.28$ (see Figure 3). This Bayes factor indicates that the observed data are 10.28 times more likely under $\mathcal{H}_+$ than under $\mathcal{H}_0$. Assuming 1-1 prior odds for $\mathcal{H}_0$ and $\mathcal{H}_+$, the observed data have increased the odds for $\mathcal{H}_+$ by a factor of 10.28, giving a posterior probability of $\mathcal{H}_+$ equal to $p(\mathcal{H}_+ \mid \text{data}) = 0.91$. This is strong evidence for a positive OSSA effect.

Now that we have evidence that the effect is positive (i.e., $\delta > 0$), we may estimate the value of δ, which gives us with a population-level estimate of the

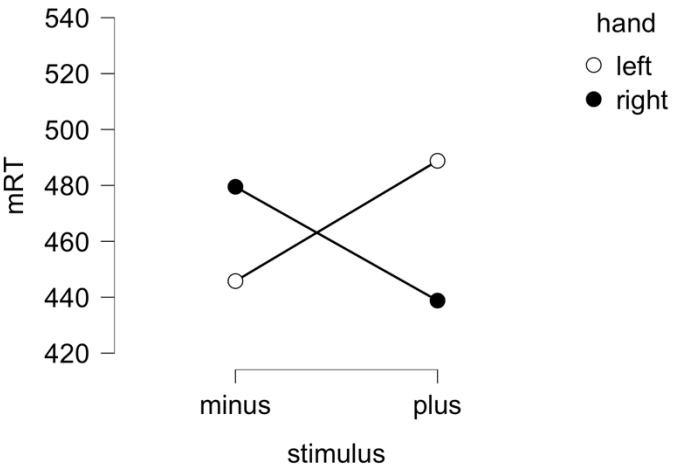

Figure 2
Mean response times (RTs) on the operation sign classification task, presented as a function of stimulus (plus sign or minus sign) and response hand (left, right).

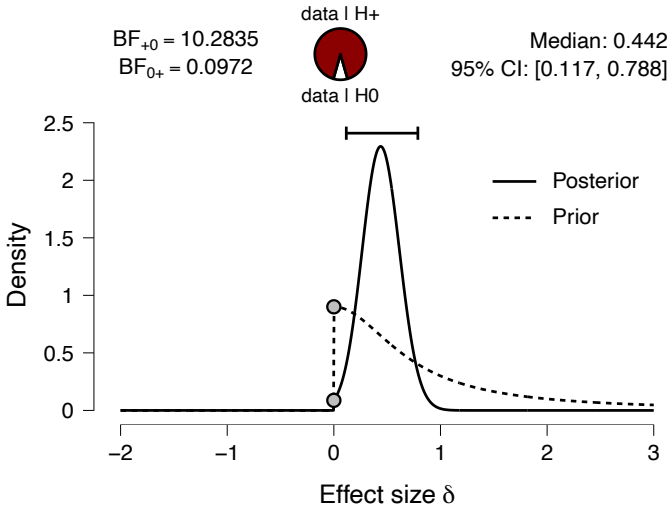

Figure 3
JASP output displaying prior and posterior distributions for the effect size δ under the hypothesis $\mathcal{H}_+: \delta > 0$.

OSSA effect. Figure 3 shows how the observed data updated our prior belief about the effect size. The dashed line (the Cauchy prior) represents the probable values of effect size that we expected *before* observing data, and the solid line (the posterior) represents the distribution of probable values of updated *after* we observed the data. The figure shows that our belief that $\delta = 0$ decreases after observing the data – note that the factor by which this decrease occurred is exactly $\text{BF}_{+0} = 10.28$. The median of the posterior distribution for δ was 0.442, and our uncertainty about the size of the effect has shifted

rightward so that 95% of the posterior distribution is between 0.117 and 0.788. As δ represents a population-level version of Cohen's d, we can say with 95% probability that the OSSA effect is a medium-to-large effect.

Sensitivity Check

The next step in our Bayesian analysis is to check the robustness of our claims under different prior settings. As explained above, the resulting Bayes factor, posterior probability for $\mathcal{H}_+$, and posterior distribution for δ depended on a specific choice of scale for the half-Cauchy prior on δ. In Figure 4, we display a plot showing the values of BF_{+0} under a range of reasonable values of *a priori* scale for δ. We can see that as the scale of the Cauchy prior increases, the values of BF_{+0} slightly decrease. The reason for this can be explained by again considering Figure 3. With a larger scale for the Cauchy prior (the dashed line), there will be slightly more mass on larger effects (i.e., the distribution will be more "spread out" and less peaked at 0). Thus, the factor by which the prior mass at $\delta = 0$ decreases to the posterior mass at $\delta = 0$ is smaller than before. As a result, the Bayes factor for $\mathcal{H}_+$ is smaller. Specifically, we see that for a scale value of $r = 1$ (a "wide" prior), we have a Bayes factor of $\text{BF}_{+0} = 8.53$, which converts to a posterior probability of $p(\mathcal{H}_+ \mid \text{data}) = 0.895$. For a scale value of $r = \sqrt{2}$ (an "ultrawide" prior), we have a Bayes factor of $\text{BF}_{+0} = 6.65$, which converts to a posterior probability of $p(\mathcal{H}_+ \mid \text{data}) = 0.87$. In both of these specific cases, we see that our observed data have given us good evidence for $\mathcal{H}_+$ (i.e., a positive OSSA effect). Thus, our conclusions do not depend on the specific choice of prior scale for under $\mathcal{H}_+$.

Sequential Analysis

Bayesian analysis also allows us to monitor the evidence as the incoming data is accumulated. In general, such sequential analysis is a strong advantage of Bayesian analyses over traditional approaches, as stopping data collection early once a certain threshold of evidence is achieved (i.e., "optional stopping") does not affect the interpretation of the resulting Bayes factor (Rouder, 2014). We have displayed this flow of evidence for our data in Figure 5. The general pattern shows increasing evidence for $\mathcal{H}_+$ against $\mathcal{H}_0$ as the number of data points increases. For the first 10 or so data points, the data actually gives slight preference to $\mathcal{H}_0$. This simply reflects the principle of parsimony – when information is minimal, the Bayes factor will give preference to the simplest model ($\mathcal{H}_0$). After 25 data points, the Bayes factor for $\mathcal{H}_+$ increases above 3, which provides a posterior probability for $\mathcal{H}_+$ greater than 0.75. As data

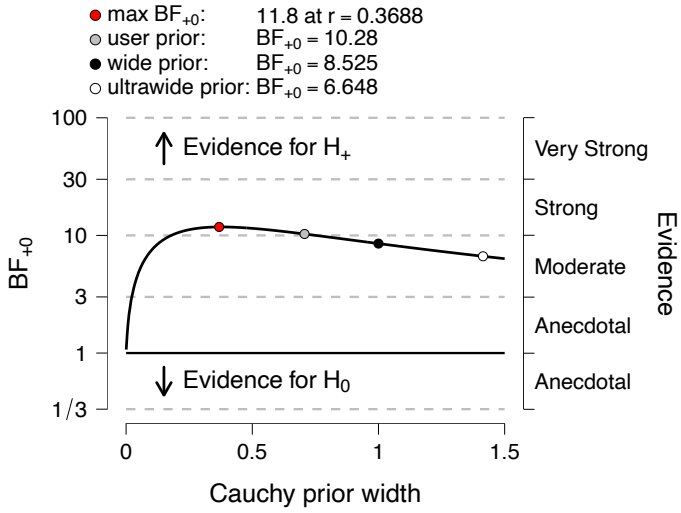

Figure 4
JASP output displaying a Bayes factors sensitivity check, where values of BF_{+0} are plotted against a range of different values of width (or scale) of the Cauchy prior for δ.

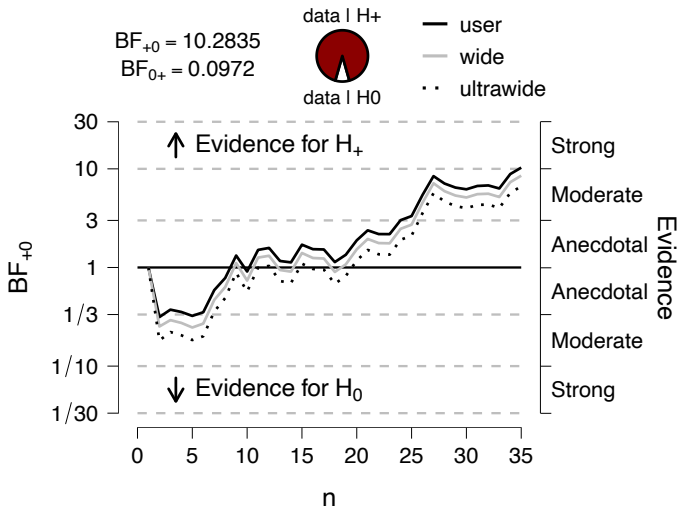

Figure 5
JASP output displaying a sequential analysis, showing the evidential flow of $\mathcal{H}_+: \delta > 0$ versus $\mathcal{H}_0: \delta = 0$ as data accumulates.

accumulates beyond $N = 25$, the level of evidence for $\mathcal{H}_+$ continues to increase accordingly. As we can see, there would be little benefit to collecting a larger sample – with $N = 35$, we have 10-to-1 posterior odds for $\mathcal{H}_+$. We think this is sufficient to provide strong support for a positive OSSA effect.

Testing with an Informed Prior

As a final analysis, we considered a Bayesian *t*-test with non-default prior specification. Though default priors are mathematically shown to perform well in an objective Bayesian sense (Rouder et al., 2009), one can argue that our *a priori* expectation about the population level effect size δ is not captured by the positive half-Cauchy distribution. As can be seen in Figure 1, the positive half-Cauchy has its greatest mass at $\delta = 0$, which would indicate that our *a priori* belief that $\delta = 0$ is greater than any other positive value of δ. This "skeptics view" about the effect may be undesirable for some. What would happen if we were to choose a prior for that placed its greatest mass over a positive effect rather than on $\delta = 0$?

To answer this question, we performed an *informed Bayesian t-test* (Gronau, Ly, & Wagenmakers, 2019). Instead of using the positive half-Cauchy as a prior distribution for δ, the informed *t*-test uses a prior distribution that matches the shape and scale of the collection of expected effect sizes elicited from expert consultation. One such informed prior that works well for a variety of situations in psychology is the Oosterwijk prior (Gronau et al., 2019), which has a median of 0.35 and 33rd and 66th percentile values of 0.25 and 0.45, respectively. This prior is mathematically specified as a scaled noncentral *t*-distribution with location 0.35, scale 0.102, and df=3 (see the right panel of Figure 1). Implementing the Oosterwijk prior in JASP gives a Bayes factor of $\text{BF}_{+0} = 25.40$ (see Figure 6). This equates to a posterior probability of $p(\mathcal{H}_+ \mid \text{data}) = 0.96$. As we can see in Figure 6, the informed prior places less mass on extreme effects than the default Cauchy, resulting in less variability in our estimate of δ, as reflected by a 95% credible interval of [0.20, 0.61]. Again, the take home message is that we have substantial evidence for a positive OSSA effect.

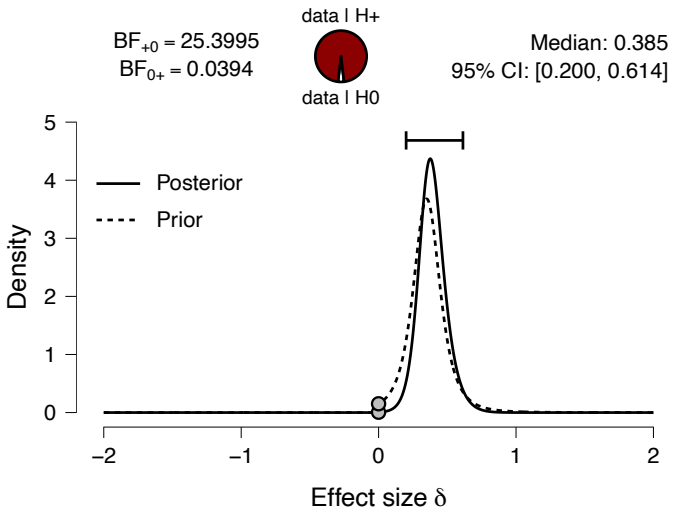

Figure 6
JASP output displaying prior and posterior distributions for the effect size under the hypothesis $\mathcal{H}_+: \delta > 0$. This analysis uses the informed Oosterwijk prior, a scaled noncentral t-distribution with location 0.35, scale 0.102, and $df = 3$.

Discussion

The purpose of this study was to replicate and confirm the operation sign spatial association (i.e., the OSSA effect) originally reported by (Pinhas et al., 2014). In our study, participants were asked to make a speeded classification of the arithmetic operation (addition or subtraction) that was represented by two mathematical operation signs (+ or -). When responses were spatially congruent (i.e., addition and subtraction mapped to the right hand and left hand, respectively), participants performed this classification more quickly than on spatially incongruent trials (i.e., addition and subtraction mapped to the left hand and right hand, respectively). These results match those originally presented by (Pinhas et al., 2014) and indicate that people may form an association between arithmetic signs and spatial location; specifically, the minus sign may evoke a leftward association, whereas the plus sign may evoke a rightward association.

Additionally, we demonstrated how to perform a complete confirmatory Bayesian analysis of the observed data in our experiment. Using the free software package JASP (Faulkenberry et al., 2020; JASP Team, 2020), we showed how to perform the key steps in a confirmatory Bayesian analysis. First, we constructed two competing hypotheses about the population-level standardized effect δ: a null hypothesis $\mathcal{H}_0$ and a positive-effect alternative hypothesis $\mathcal{H}_+$. We then performed a Bayesian *t*-test (Rouder et al., 2009) on participants' mean differences in RTs between incongruent and congruent trials. The *t*-test produced a Bayes factor of 10.3, indicating that our observed data were approximately 10 times more likely under $\mathcal{H}_+$ than under $\mathcal{H}_0$. These 10-to-1 posterior odds are equivalent to a posterior model probability of 0.91 for $\mathcal{H}_+$. Further, the *t*-test allowed us to estimate with 95% probability the value of δ, which we saw was between 0.12 and 0.79. In all, we have strong evidence for a medium-to-large OSSA effect, indicating that people indeed form associations between operation signs and spatial location.

The key mechanism in our model comparison was the Bayes factor (Faulkenberry, 2022; Kass & Raftery, 1995), the computation of which requires the

analyst to specify a *prior* for δ under $\mathcal{H}_+$. That is, before observing data, one must first specify a probability distribution that mathematically encodes the variability of effect sizes one expects to obtain in the experiment. We initially did this using *default* specifications (i.e., an objective Bayesian approach, Kass & Wasserman, 1996) and employed the positive half Cauchy distribution with scale $1/\sqrt{2}$. To test the robustness of our results to this prior specification, we performed two additional sensitivity checks. First, we recomputed Bayes factors obtained from different values of scale for the Cauchy distribution. In general, Bayes factors decreased slightly as scale increased, though all remained sufficiently evidential for a positive OSSA effect. Second, we performed an informed Bayesian *t*-test using the *Oosterwijk* prior (Gronau et al., 2019), a scaled noncentral *t*-distribution specifically chosen to reflect an *a priori* belief that if $\mathcal{H}_+$ is the chosen model, then the effect size δ should be small to medium in size, centered at 0.35, with 33rd and 66th percentiles equal to 0.25 and 0.45, respectively. This informed prior produced a Bayes factor for $\mathcal{H}_+$ over 20 (and consequently, a posterior probability for $\mathcal{H}_+$ over 0.96). As a result, we are quite confident in the evidential value of our data and feel strongly that the OSSA effect is a real cognitive phenomenon worth further study.

To this end, we now speculate on some possible reasons why people should exhibit an association between operation signs and spatial location. One possibility is that operation signs evoke dynamic mental representations that are similar to moving one's attention on a mental number line (i.e., rightward for addition and leftward for subtraction). This view has gained traction in the literature (Marghetis & Núñez, 2013; Marghetis et al., 2014) and reflects a core assumption of some recent theories about the nature of mental arithmetic (Fayol & Thevenot, 2012; Mathieu, Gourjon, Couderc, Thevenot, & Prado, 2016; Uittenhove, Thevenot, & Barrouillet, 2016). Alternatively, the association may simply stem from long-term memory processes. For example, it may be the case that perceiving a plus sign activates a long-term memory representation of "adding", which in general results in quantities of larger magnitude. Similarly, a minus sign may activate representations of smaller magnitude. This may then work in concert with memory representations of conventional number lines being ordered in increasing magnitude from left to right to produce the observed association. Pinhas et al. (2014) also speculated about these two competing accounts of the OSSA effect and pointed out that while OSSA correlated positively with another task designed to capture operational momentum, it did not correlate with the SNARC effect. Because SNARC is often thought to reflect a mental number line (i.e., a long-term memory representation abstracting the general experience of seeing small numbers with the left side of space and large numbers with the right side of space), the lack of correlation between SNARC and OSSA calls into question any account for OSSA that is based on similar long-term memory processes.

Additionally, Pinhas et al. (2014) pointed out that the congruity effect was larger for the plus sign than for the minus sign, ruling out a polarity correspondence account often used to explain SNARC (e.g., Proctor & Cho, 2006). We observed a similar pattern in Figure 2, but we did not explicitly test this. Pinhas et al. (2014) speculated that this asymmetry stems from the fact that the negative sign has multiple mathematical contexts in which it is typically used, and thus, it is more difficult to assign the negative sign to a particular spatial context. This would, in effect, attenuate the magnitude of the leftward operational momentum of the negative sign compared to the rightward momentum of the addition sign. Future studies could indeed test this claim by introducing a neutral condition to separate the congruity effect into facilitation and inhibition components, as is typically done in experiments with the size-congruity effect (e.g., Henik & Tzelgov, 1982).

In summary, we successfully replicated the original observation by Pinhas et al. (2014) of an association between arithmetic operation signs and spatial location. Further, we described how to perform a confirmatory Bayesian analysis of the observed data using the free software package JASP. We conclude that there is substantial evidence for a positive OSSA effect. We believe that this confirmatory work situates operational-spatial associations as a serious line of inquiry in numerical cognition that is worthy of further exploration. Further, we hope that researchers can use the methods described here as a way to conduct their own confirmatory work.

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Correspondence concerning this article should be addressed to Thomas J. Faulkenberry, Department of Psychological Sciences, Box T-0820, Tarleton State University, Stephenville, TX 76401. E-mail: faulkenberry@tarleton.edu

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THE GENETICS OF INDIVIDUALISM-COLLECTIVISM: A SYSTEMATIC REVIEW

RACHEL E. HSU & GRACE A. SULLIVAN

WESLEYAN UNIVERSITY

Culture and Genetics

Culture can be defined as the learned patterns of human cognition and behavior that are shared and transmitted amongst members of a group (Linton, 1945). Culture has traditionally been thought to be independent of genetics, and vice versa (Parson, 1949). Gene-culture coevolution theory challenged this definition and proposed that these two evolutionary processes – genetic and cultural – cannot be separated; what is learned may depend on the individual's genotype, and biological evolution may be affected by culture (Boyd & Richerson, 1985). The development of genome-wide sequencing and the rise of genomics further support gene-culture coevolution theory, as more polymorphisms across different populations are being discovered, with functional effects and cultural associations (Richerson et al., 2010). Based on gene-culture coevolution theory, individualism-collectivism both drives and is subject to genetic selection (Laland et al., 2010).

Individualism and Collectivism

The concept of individualism and collectivism in this context is in reference to different cultures. Individualist cultures promote independence and value individuality and an internal locus of control, whereas collectivist cultures promote interdependence and value connectedness and behaviors following the social context (Triandis, 1995). Although independence and interdependence are present in all cultures and within all people, individualism tends to center the individual versus collectivism which tends to center the group (Oyserman & Lee, 2008). Collectivism and individualism are associated with cognitive and behavioral differences and differences in neural changes in connectivity (Kitayama et al., 2011). Collectivism is also associated with more aversive response to social errors such as troubling others, due to the emphasis on interpersonal relationships and social norms (Rapp et al., 2021). Gene-culture coevolution theory has established the bidirectional relationship between the cultural environment and genetic variation, with both components subject to environmental selective pressures (Feldman & Laland, 1996; Gintis, 2011; Laland et al., 2010; Richerson et al., 2010). The selection of interdependent behaviors such as cooperation and sharing were facilitated by a culture where there was a need for such behaviors (Gintis, 2011). The origin of cross-cultural differences in individualism-collectivism can be attributed to the relative presence of pathogens in the environment (Fincher et al., 2008). As a major selection pressure, infectious diseases encouraged more collectivist behaviors such as conformity among the affected populations to inhibit transmission and enhance the likelihood of survival (Murray et al., 2011). Higher historical pathogen prevalence was found to be positively correlated with behavioral conformity and obedience and negatively correlated with dispositional variability and left-handedness – a sign of nonconformity (Murray et al., 2011). It appears increased historical pathogen prevalence in collectivist regions contributed towards the selection of the genetic variants, which in turn enhanced interdependent values (Chiao & Blizinsky, 2009).

Gap in Current Reviews

Although gene-culture coevolution theory has been well established since the 1980s by Boyd and Richerson (1985), decades later the study of the genetic basis of culture orientation remains largely theoretical (Laland & Brown, 2002). Understanding the effects of genetic variation on culture can shed light on which biological systems and genes interact with cultural experiences to develop a cultural identity. A comprehensive review of the existing literature examining the genetic markers of individualism-collectivism was published by Way and Lieberman in 2010; in this context, social sensitivity was

operationalized as the degree of emotional responsiveness to the social environment and experiences. The review found that variants in the *5-HTTLPR* region of the serotonin transporter gene, the *A118G* SNP in the μ-Opioid receptor gene, and variation in the *MAOA* gene were all significantly correlated with social sensitivity and higher frequency of these alleles have been found in collectivist cultures (Way & Lieberman, 2010).

The literature review by Way and Lieberman (2010) summarized the empirical research in the field concisely. However, this paper was published in 2010 and over a decade of new research has been conducted since. There is new evidence regarding the systems and genetic variants Way and Lieberman addressed and novel biological systems connected to individualism-collectivism have been identified. Thus, there is a crucial need for a review of the research since Way and Lieberman's publication. As to which biological systems should be reviewed, Way and Lieberman examined the serotonin system, opioid system, and *MAOA* gene. Since 2010, the research on genetic variation and individualism-collectivism has been focused on new systems such as the oxytocin and dopamine system, rather than the opioid system and MAOA gene. Our systematic literature review would be an update on more recent research regarding polymorphisms associated with collectivism versus individualism, with a focus on the serotonin, oxytocin, and dopamine systems in relation to cultural orientation.

Biological Systems Reviewed

Serotonin System, Social Behaviors, and Sensitivity

The serotonin system modulates many different behaviors including mood, perception, and social sensitivity (Berger et al., 2009). Different allelic frequency of the functional polymorphism in the promoter region of the serotonin transporter gene (*5-HTTLPR*) are associated with different serotonin levels (Heils et al., 1996). The short (s) allele results in decreased production of the serotonin transporter and less serotonin reuptake compared to the long (l) allele (Lesch et al., 1994). Previous research had found that the *5-HTTLPR* s allele associated with social sensitivity was present at much higher rates in collectivist countries (Chiao & Blinzinsky, 2010). Higher sensitivity to social cues and rejection would be advantageous in collectivist cultures, where conformity and others' perceptions of oneself are valued; furthermore, collectivism would facilitate higher levels of well-being in socially sensitive populations (Way & Lieberman, 2010).

Oxytocin System, Social Behaviors, and Empathy

Oxytocin (OXT) is a neuropeptide that is associated with empathy, emotions, and social bonding across cultures (Geng, 2018). Besides examining oxytocin receptor expression levels in regions of the brain, genetic variants also provide insight regarding the relationship between OXT and social behaviors (Gimpl & Fahrenholz, 2001). Many polymorphisms have been identified on the oxytocin receptor (*OXTR*) gene, which affects oxytocin binding levels (Gimpl & Fahrenholz, 2001). The *OXTR* rs53576 polymorphism has two genetic variants, with the A allele associated with greater sensitivity and loneliness compared to the G allele (Lucht et., 2009). The *OXTR* rs2254298 is also differentiated by an A allele and G allele, and the G/G genotype is associated with lower levels of OXT and social engagement (Feldman et al., 2012). The *OXTR* rs2268498 SNP has either a T or C nucleotide and the T allele is associated with lower *OXTR* mRNA levels as well as less pain perception accuracy (Reuter et al., 2016). Similar to variation in the serotonin system, the genotype frequency of the variant associated with higher sensitivity would be expected to be higher in collectivist cultures for *OXTR* polymorphisms, as collectivist cultures value social sensitivity and empathy more than individualist cultures.

Dopamine System and Cultural Learning

Dopamine (DA) is a neurotransmitter that is associated with learning and memory consolidation, especially in regard towards occurrences that are motivationally significant (Arias-Carrión et al., 2010). Most literature on dopaminergic pathways and dopamine receptor (DR) genes have been examining risk-taking and drug-seeking reward (Di Ciano et al., 2014). Less studied is the association between that dopamine D4 receptor gene (*DRD4*) and cultural learning (Kitayama et al., 2014). A variable number tandem repeat polymorphism in the *DRD4* ranges from 2 to 11 tandem repeats, with 7-, 4-, or 2-repeats (7R, 4R, 2R) being the most common (Wang et al., 2004). The 7R or 2R repeat (7/2-R) alleles in particular are associated with less feedback inhibition and more DA signaling (Wang et al., 2004). The 2R allele is more prevalent among Asians and the 7R allele is found more frequently in Western populations (Reist et al., 2007). Since both 7/2-R alleles enhance sensitivity, cross-cultural differences in individualism-collectivism can be examined as moderators regarding *DRD4* and behavior.

Method

Search Strategy

This systematic review was conducted using PRISMA (Preferred Reporting Items for Systematic

Reviews and Meta-Analyses) guidelines (Page et al., 2021). Based on the past review by Way and Lieberman in 2010 and preliminary research, we identified three biological systems on which we conducted our review of genetic variation associated with individualism-collectivism: The serotonin system, the oxytocin system, and the dopaminergic system. The opioid system and *MAOA* gene are not included in this review due to lack of new evidence on these systems. Separate searches were conducted for genetics of cultural orientation in (a) the serotonin system; (b) the dopamine system; and (c) the oxytocin system. Papers were sourced from the databases PubMed and Web of Science based on keywords: (a) (Genetics) AND (culture) AND (serotonin); (b) (Genetics) AND (culture) AND (dopamine); (c) (Genetics) AND (culture) AND (oxytocin).

Inclusion and Exclusion Criteria

Research was limited to original empirical candidate gene association studies published from 2011 onwards and with human subjects. Studies were excluded if (culture) or (cultural) or (social) or (interdependence) were not found in the title or abstract. Studies were also excluded if (cultured) or (disease) or (drug) or (cell) were included in the title or abstract, as those words incorporated studies on cancer and drug research. Studies that did not pertain to individualism-collectivism, independence-interdependence, or cultural orientation were also eliminated.

Results

Screening Process

Serotonin System

PubMed yielded 290 results and Web of Science yielded 53 results. Through reviewing the titles and abstracts for keywords, 263 articles from PubMed and 46 articles from Web of Science were not relevant. Of the 27 relevant papers from PubMed, two met the inclusion criteria and were relevant to individualism-collectivism, three additional papers were added. One was identified as it had the same first author as another article; two were identified from the references section of included articles. Of the seven relevant papers from Web of Science, one met the inclusion criteria and was relevant to individualism-collectivism. A total of six papers pertaining to the association between the serotonin system and cultural orientation were identified. These six studies are shown in Table 1.

Oxytocin System

PubMed yielded 74 results and Web of Science yielded 21 results. Through reviewing the titles and abstracts for keywords, 61 articles from PubMed and 10 articles from Web of Science were not relevant. Of the 13 relevant papers from PubMed, three met the inclusion criteria and were relevant to individualism-collectivism. Of the 11 relevant papers from Web of Science, four met the inclusion criteria and were relevant to individualism-collectivism, and one paper was removed as a duplicate result. Two additional papers were identified and added as it had the same first author as other articles. A total of eight papers pertaining to the association between the oxytocin system and cultural orientation were identified. These eight papers are shown in Table 2.

Dopaminergic System

PubMed yielded 701 results and Web of Science yielded 83 results. Through reviewing the titles and abstracts for keywords, 685 articles from PubMed and 79 articles from Web of Science were not relevant. Of the 16 relevant papers from PubMed, four met the inclusion criteria and were relevant to individualism-collectivism. Of the four relevant papers from Web of Science, one met the inclusion criteria and was relevant to individualism-collectivism but was removed as a duplicate result. A total of four papers pertaining to the association between the dopaminergic system and cultural orientation were identified. These four papers are shown in Table 3.

Genetic Variation and Individualism-Collectivism

Serotonin System and Cultural Orientation

Five of the articles examined the *5-HTTLPR* polymorphism in relation to self-construal (Ma et al., 2013), negative self-reflection (Ma et al., 2014), sensitivity to facial expressions (Ishii et al., 2014), migrant life satisfaction (Kashima et al., 2014), and death anxiety/depression (Luo et al., 2017). One article examined the rs6311 SNP (guanine vs. adenine) in the serotonin 2A receptor gene (*HTR2A*) in relation to the social sharing of happiness (Matsunaga et al., 2021). Five of the studies used a PCR method to determine s/s, s/l, or l/l genotype for *5-HTTLPR* or the *HTR2A* genotype of their sample (Ma et al., 2013; Ma et al., 2014; Ishii et al., 2014; Luo et al., 2017; Matsunaga et al., 2021). One study used previously-estimated allelic frequencies of the *5-HTTLPR* s allele across 14 countries and compared allelic frequency averages to the cultural orientation of the regions (Kashima et al., 2014).

Three studies exclusively examined Chinese participants (Ma et al., 2013; Ma et al., 2014; Luo et al., 2017), three studies recruited Japanese participants as well as European and East Asian Americans (Ishii et al., 2014) or Chicago residents of unspecified ethnicity (Matsunaga et al., 2021), one study examined immigrants to Australia with 17 different countries of origin (Kashima et al., 2014). In three studies, individualism-collectivism

Table 1
Results from Serotonin System Studies

	Genetic Variant[s]	Sample Size	Population	Findings	Other Factors of Note
Ma et al., 2013	*5-HTTLPR* s/l allele	n = 34	Chinese	l/l genotype show different brain activity during self-construal	Anxiety traits, Brain regions
Ishii et al., 2014	*5-HTTLPR* s/l allele	n = 196 n = 47 n = 153	White, Asian American, Japanese	s/s genotype more sensitive to facial expression for Japanese but not American	Cultural exposure Cultural ingroup-outgroup
Ma et al., 2014	*5-HTTLPR* s/l allele	n = 60 n = 40	Chinese	s/s genotype feel more distress over own negative traits	Social group
Kashima et al., 2014	*5-HTTLPR* s/l allele	n = 1167	Respondents from 14 countries	Migrants from countries with higher l allele prevalence were more satisfied	Cultural factors, National average Life satisfaction (NALS)
Luo et al., 2017	*5-HTTLPR* s/l allele	n = 1684	Chinese	l/l genotype and interdependence moderated death anxiety/depression	Cultural values, Neuroticism
Matsunaga et al., 2021	rs6311 SNP in *HTR2A* gene	n = 207 n = 200	Japanese, Americans	G allele carriers felt happier with social sharing for both cultures	Cultural factors Subjective happiness levels

Table 2
Results from Oxytocin System Studies

	Genetic Variant[s]	Sample Size	Population	Findings	Other Factors of Note
Kim et al., 2011	*OXTR* rs53576 G/A alleles	n = 99 n = 45 n = 107	Korean Asian American, White	G/G genotypes exhibit more culturally relevant emotional regulation; more suppression for Koreans and less for Asian Americans	Culture, Cognitive reappraisal
Luo and Han, 2014	*OXTR* rs53576 G/A alleles	n = 14938	Respondents from 12 countries	Higher A allelic frequency associated with more collectivist cultural values across populations	MDD, Pathogen prevalence
Luo et al., 2015	*OXTR* rs53576 G/A alleles	n = 1536 n = 60	Chinese	Interdependence and empathy associated more strongly with G/G genotypes	Empathy traits, Cultural Orientation
Butovskaya et al., 2016	*OXTR* rs53576 G/A alleles, rs2254298 G/A alleles	n = 4852 n = 4922	Respondents from 18 populations	Asian populations had higher A allelic frequency of both polymorphisms, possibly related to parental practices	Region, Population, Parental investment
Montag et al., 2017	*OXTR* rs53576 G/A alleles, rs2254298 G/A alleles, rs2268498 T/C alleles	n = 537 n = 280	White, Chinese	rs2268498 T/T genotypes had lower AQ scores, lower C allelic frequency in Chinese population	Autism-Spectrum Quotient (AQ), Empathy traits, Gender

Table 2 (continued)
Results from Oxytocin System Studies

	Genetic Variant[s]	Sample Size	Population	Findings	Other Factors of Note
Luo et al., 2019	*OXTR* rs53576 G/A alleles	n = 50	Chinese	A/A genotypes had empathic neural response to painful facial expressions that shared both racial and in-group identity	In-group bias, Race, Facial expression, Empathy traits
Luo et al., 2020	*OXTR* rs53576 G/A alleles	n = 240	Chinese	A allele carriers had stronger resting-state connectivity; stronger connectivity in the basal ganglia and thalamus is correlated with interdependence	Cultural Orientation, Resting-state network
Lee et al., 2022	OXTR expression in the ACC	n = 2504	Respondents from 26 ethnic samples	Higher OXTR expression in the ACC was correlated with tighter culture and higher socio-ecological threats	*OXTR* SNPs, Cultural tightness-looseness (CTL), Socio-ecological threats, Neuroendophenotypes

Table 3
Results from Dopamine System Studies

	Genetic Variant[s]	Sample Size	Population	Findings	Other Factors of Note
Kitayama et al., 2014	*DRD4* 7/2-R allele	n = 194 n = 204	White American, East Asian	7/2-R carriers had greater congruence with the dominant social orientation (i.e. interdependence for East Asians)	Cultural orientation, Cultural learning
Yu et al., 2018	*DRD4* 7/2-R allele	n = 66 n = 66	White American, East Asian	Gray matter volume greater in White Americans and difference is more significant in 7/2-R carriers	Brain regions of interest, Cultural orientation
Glazer et al., 2020	*DRD4* 7/2-R allele	n = 41 n = 41	White American, East Asian	Reward-Positivity differences more significant in 7/2-R carriers, not moderated by culture	Cultural Orientation, Reward processing,
Kitayama et al., 2020	*DRD4* 7/2-R allele	n = 66 n = 66	White American, East Asian	Grey matter volume of the TPJ greater for East Asians and difference is more significant in 7/2-R carriers	Cultural Orientation, Temporoparietal junction (TPJ)

was operationalized as the ethnicity or nationality of the participants, with East Asian participants representing collectivist or interdependent cultures (Ishii et al., 2014; Luo et al., 2017; Matsunaga et al., 2021). In two of these studies, American samples represented individualist culture (Ishii et al., 2014; Matsunaga et al.). In one article, the interdependence of self-construal was determined to be a measurement of interdependent culture (Ma et al., 2013). One article used *5-HTTLPR* s or l allele frequency to assess a culture to be individualistic or collectivistic as the s allele is more prevalent in collectivist cultures (Kashima et al., 2014). One article did not specify which cultures were individualist versus collectivist (Ma et al., 2014).

One article found no effect of Gene x Culture interactions: Individualism-collectivism had no effect on social sharing of happiness, rather the *HTR2A* gene G carriers vs. A/A genotype modulated happiness in the presence of a friend (Matsunaga et al., 2021). Another article found an effect in a contradictory direction: l/l genotypes and independence moderated death anxiety/depression but interdependence had no effect in the s/s genotype group (Luo et al., 2017). The remaining four articles found significant effects of *5-HTTLPR* s or l frequency on negative self-reflection (Ma et al., 2014), the judgement of facial expression (Ishii et al., 2014), life satisfaction after immigration (Kashima et al., 2014), and interdependent self-construal (Ma et al., 2013) – all mediated by interdependence or cross-cultural differences.

The Oxytocin System and Cultural Orientation

Seven studies examined the relationship between the *OXTR* rs53576 polymorphism and cross-cultural emotional regulation (Kim et al., 2011), collectivist cultural values (Luo & Han, 2014), interdependence and empathy (Luo et al., 2015), allelic frequencies in world populations (Butovskaya et al., 2016), autistic traits in ethnic/cultural groups (Montag et al., 2017), empathic response to in-group pain (Luo et al., 2019), and resting-state brain network properties (Luo et al., 2020). Two studies also evaluated the rs2254298 polymorphism (Butovskaya et al., 2016; Montag et al., 2017) and one study investigated both polymorphisms and variation in *OXTR* rs2268498 as well (Montag et al., 2017). One article examined OXTR expression in the anterior cingulate cortex (ACC) across populations and cultural tightness-looseness, which corresponds to levels of homogeneity in social values and behaviors (Lee et al., 2022).

Three studies exclusively examined Chinese participants (Luo et al., 2015; Luo et al., 2019; Luo et al., 2020); in addition to the Chinese sample, one study also investigated White participants (Montag et al., 2017). One study recruited Korean participants as well as European and East Asian Americans (Kim et al., 2011). Two studies obtained genetic variance data from the 1000 Genomes databases that included DNA samples from 18 populations from different regions of the world (Butovskaya et al., 2016) and 26 samples from different ethnicities (Lee et al., 2022). One study compiled data from 36 publications across 12 countries (Luo & Han, 2014). PCR was used to genotype *OXTR* polymorphisms in five studies (Kim et al., 2011; Luo et al., 2015; Butovskaya et al., 2016; Montag et al., 201; Luo et al., 2020). Three studies used data from participants that had already been genotyped (Luo & Han, 2014; Luo et al., 2019; Lee et al., 2022). In seven studies, individualism-collectivism was operationalized as the ethnicity or nationality of the participants, with East Asian participants representing collectivist or interdependent cultures (Kim et al., 2011; Luo & Han, 2014; Luo et al., 2015; Butovskaya et al., 2016; Montag et al., 2017; Luo et al., 2019; Luo et al., 2020). In four of these studies, White or Western samples represented individualist culture (Kim et al., 2011; Luo & Han, 2014; Butovskaya et al., 2016; Montag et al., 2017). One article did not specify which cultures were individualist versus collectivist (Lee et al., 2022).

All articles found a significant effect of *OXTR* polymorphisms on social behaviors, mediated by individualism-collectivism and/or interdependent qualities (Table 2). However, some of the studies found significant effects in potentially contradictory directions. For the *OXTR* rs53576 polymorphism, three of the studies found interdependence/collectivism positively correlated with A allelic frequency (Luo & Han, 2014; Butovskaya et al., 2016; Luo et al., 2020). Although one study found that interdependence and more empathy was associated with G/G genotypes (Luo et al., 2015), these findings are not completely opposing as allelic frequency in a population is not comparable to the genotype of an individual, but it does suggest some potential inconsistencies.

The Dopamine System and Cultural Orientation

All four studies examined the relationship between *DRD4* 7/2-R allele carriers and cultural learning of social orientation (Kitayama et al., 2014), gray matter volume of the prefrontal cortex in different populations (Yu et al., 2018), cross-cultural reward processing (Glazer et al., 2020), and grey matter volume of the temporoparietal junction in different populations (Kitayama et al., 2020).

All four studies examined European Americans and Asian-born East Asian participants (Kitayama et al.,

2014; Yu et al., 2018; Glazer et al., 2020; Kitayama et al., 2020). PCR was used to find the *DRD4* genotype of participants in four studies (Kitayama et al., 2014; Yu et al., 2018; Glazer et al., 2020; Kitayama et al., 2020). In all studies, individualism-collectivism or independence-interdependence was operationalized as the ethnicity or nationality of the participants, with East Asian participants representing collectivist or interdependent cultures (Kitayama et al., 2014; Yu et al., 2018; Glazer et al., 2020; Kitayama et al., 2020). In four of these studies, European American samples represented individualist culture (Kitayama et al., 2014; Yu et al., 2018; Glazer et al., 2020; Kitayama et al., 2020).

One study predicted and found no effect for Culture x *DRD4* interaction moderating reward processing, indicating that reward processing was conserved across individualism-collectivism (Glazer et al., 2020). The other three studies all found significant effects of *DRD4* 7/2-R alleles on adhesion to dominant social orientations (Kitayama et al., 2014), cultural differences in grey matter volume and prefrontal cortex thickness (Yu et al., 2018), and cultural differences in grey matter volume in the perspective-taking temporoparietal junction (Kitayama et al., 2020) – all mediated by interdependent-independent cultural experiences.

Discussion

Most of the research across the three systems found a significant association between genetic variation and culture, however, some of the results from the studies are potentially contradictory. Of the six studies related to the serotonin system and cultural orientation, five articles found significant cross-cultural differences in the 5-*HTTLPR* allele frequency and effects on different social behaviors (Table 1). However, one of the studies only found an independent effect of l/l genotypes and independent culture on death anxiety/depression, meaning that interdependence did not mediate this behavior in people with the s/s genotype (Luo et al., 2017). The other four studies found both cultural orientations interacted with *5-HTTLPR* variations were associated with behavioral differences (Ma et al., 2014; Ishii et al., 2014; Kashima et al., 2014; Ma et al., 2013).

In the literature regarding the oxytocin system and individualism-collectivism, all eight studies found significant effects of different *OXTR* polymorphisms on social behaviors and empathy (Table 2). This provides support for an association between oxytocin receptor gene and cultural orientation, especially the rs53576 SNP – which seven studies had evaluated. However, which allele or genotype is correlated with cross-cultural behavioral differences is uncertain. There are potentially contradictory results regarding rs53576. Three of the studies found interdependence correlated with A allelic frequency (Luo & Han, 2014; Butovskaya et al., 2016; Luo et al., 2020). However, one study found that G/G genotypes were associated with interdependence (Luo et al., 2015). Thus, we can conclude that *OXTR* Polymorphisms x Culture interactions may be associated with behavioral differences, but the strength, direction, and context of the effect is uncertain (Table 2).

Lastly, regarding the research related to D4 dopamine receptors and culture, three of the four studies found significant effects (Table 3). For example, Kitayama (2014) found that carriers of the 7/2-R alleles have greater congruence with the dominant social orientation – individualism in Western populations and collectivism in Asian populations – since those genetic variants are associated with greater sensitivity towards socialization and enculturation events. The one study finding no effect of the *DRD4* 7/2-R alleles and individualism-collectivism was expected as dopaminergic rewards systems are constant cross-culturally (Glazer et al., 2020).

The effects of genetic variation on cultural differences are inconclusive based on the current literature. In the serotonin and oxytocin system, the research presents contradictory results (Table 1; Table 2); for example, Luo and Han (2014) found the A allele of *OXTR* rs53576 to be associated with collectivist culture while analyzing culture based on the individualism-collectivism scores for 12 nations, whereas Luo and colleagues (2015) found the G/G genotype of rs53576 to be associated with interdependence by measuring independence/interdependence using a 24-item survey that participants completed. This is possibly due to the different measures used by different studies. Another clear issue with the research methods is the sample size. The sample sizes in many of these studies would not lend enough power to detect the small effect sizes that are common in behavioral genetics; some researchers suggest that a sample size of at least 1000 per condition is necessary to detect the effect of a polymorphism (Zondervan & Cardon, 2007). The association between genetic variation and culture is very context dependent; the contradictory results of studies can be attributed to several complications, making it difficult to conclusively detect the genetic effects of culture.

There are still many limitations to investigations of individualism-collectivism genetics. Most of the studies across all three neurotransmitter systems measured collectivism and interdependence using East Asian samples and individualism and independence using White American samples. Currently there is a lack

of representation from non-western individualist and non-East Asian collectivist cultures. Future research should aim to expand the populations and nations sampled. This literature review analyzed a limited number of articles within the three targeted biological systems. Other genetic variations in opioid system and *MAOA* gene were not analyzed due to a lack of research being conducted since 2010, however, there may be polymorphisms or variants of interest that were overlooked because of this focused approach. More research should be done across many different systems examining the association between genetics and social behaviors with cultural orientation as a potential mediator.

Additionally, extreme caution is advised when interpreting evidence connecting genetic variation to cultural differences, because overstating findings and misinterpreting them to reinforce ethnic stereotypes can be harmful. Although considering potential genetic contributions to individuals' cultural orientations provides interesting and valuable information to enrich our understanding of how natural biological variation across humans can contribute to the diversity of human behaviors and cognitive tendencies (and hopefully encourage compassion for innate differences), genetic associations do not confirm causal relationships and the evidence presented in this review does not suggest that genetics is the decisive source of social traits and ethnic differences. Many of these studies do measure ethnic difference, but what is actually being examined is allelic frequency differences that are found across population due to common shared ancestry in a region. Not all individuals of a population share the same genotype, thus it would be ignorant to attribute one variant to a population (Witherspoon et al., 2007). The results from these studies should be carefully interpreted, as genetic evidence with human subjects is never causal evidence, and this research should not be used to feed into stereotypes about races or ethnicities. Environmental factors that are shared in a population or culture could explain why the correlations occur. For example, individuals with s/s genotype of *5-HTTLPR* were more sensitive to facial expression only when it was culturally relevant; the Asian American sample had similar allelic frequencies as the Japanese sample, but their pattern was similar to White Americans (Ishii et al., 2014).

The genetic basis of cultural orientation is worth studying because it is possible collectivism and interdependent values help mitigate the potential negative effects of social sensitivity associated with some genetic variants. More than a decade ago, Way and Lieberman found that a higher prevalence of the *5-HTTLPR* s polymorphism in collectivist countries was negatively correlated with the prevalence of depression, suggesting that collectivism helped reduce depression in populations with increased social sensitivity (2010). However, Luo and colleagues (2017) found no effect of interdependence on death-related anxiety/depression in homozygous s/s individuals, which challenges the idea that collectivist culture serves as a buffer against the risk of anxiety and/or depression in s allele carriers (Chiao & Blizinsky, 2010). Investigating the genetics of individualism-collectivism and the underlying cultural differences in social sensitivity can help us identify which gene-environment interactions and risk factors make some cultural groups at higher risk for depression and anxiety.

Conclusion

This systematic review examines the literature on polymorphisms in the serotonin, oxytocin, and dopamine system in relation to individualism-collectivism orientation. Overall, there is some evidence for associations between genetic variation in these systems and individualism-collectivism; however, the specific nature of and contextual factors involved with these associations are inconclusive. Studies across two of the three biological systems examined presented contradictory results, which is potentially due to heterogenous measures of variables and poor reliability of the results due to insufficient sample size. Gaps in the literature regarding sampling and limited research in general should be addressed to better generalize and verify the findings analyzed in this literature review.

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Author Note

Correspondence concerning this article should be addressed to Grace A. Sullivan, Email: gsullivan@wesleyan.edu

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VICTIM BLAMING:
A REPLICATION AND EXTENSION OF MUEHLENHARD ET AL. (1985)

MAGGIE LUONG & WIND GOODFRIEND

BUENA VISTA UNIVERSITY

Abstract – Victim blaming is an important topic in sexual assault and rape scenarios. A classic psychology study by Muehlenhard et al. (1985) established that victim blaming does occur and varies depending on several situational factors. The current study replicated Muehlenhard et al. (1985) and extended it in several ways, including the addition of women as participants (originally it was only men) and of new variables. After reading fictional scenarios describing a first date between "John" and "Mary", 254 participants indicated whether John was "justified" in various sexual behaviors without Mary's consent (i.e., the measure of victim blaming). Results showed very low scores for justification of rape and for less severe (but still without consent) sexual behaviors regardless of the date circumstances included in this study, a lack of replication. However, victim blaming for the less severe sexual behaviors (such as unwanted kissing or fondling Mary) was positively correlated with levels of participant sexism and endorsement of rape myths. Men also showed more victim blaming than women. No significant correlations were found for participant age, social desirability, or belief in a just world. Implications regarding cultural and individual attitudes about sexual assault are discussed.

Perceptions of sexual assault and rape have changed over the decades, in terms of both criminal justice response and individual people's perceptions. Regarding criminal justice, many definitions and laws have seen updates. Some common changes across U.S. states are the addition of marital rape as a crime, exclusion of required witness corroboration, and the creation of rape shield laws. One of the most recent substantial changes is the revised definition of rape in mid-2012 by excluding the word "forcible" to encompass the penetration of any genitals with any body part or object without consent (United States Department of Justice, 2012). The new definition is more inclusive in terms of types of act and types of victim (e.g., male victims are now acknowledged).

These changes in the classification of rape as a crime have also affected the reported incidents of rape. Before the definition was changed in mid-2012, rape reports came from 25.9 out of every 100,000 people—whereas after the definition changed that year, reporting went up to 35.9 out of every 100,000 (Federal Bureau of Investigation, 2020). By 2018, rates had risen to 44 per 100,000 people. It is unclear from these numbers whether actual incidents of rape had gone up, or whether changing definitions and cultural beliefs about rape led to more reporting. In other words, changing public opinion may influence how survivors interpret what happens to them and whether they feel safe reporting assaults or rapes to any kind of authority.

Muehlenhard et al. (1985) conducted a groundbreaking study regarding perceptions of rape. They asked 168 undergraduate men to read one of nine fictional dating vignettes (randomly assigned) about John and Mary. The vignettes varied on two independent variables: who initiated the date (John asked, Mary asked, or Mary hinted until John asked) and the dating activity (going to a movie, John's apartment, or a religious event). After reading their version of the vignette, participants completed a series of questions about sexual behaviors that might occur. The most intriguing results came from questions about whether John would be "justified" in having sex with Mary "against her will." The word "rape" was purposely avoided in the study to avoid social desirability in responses.

The results provided evidence of victim blaming (Muehlenhard et al., 1985). Victim blaming is generally defined as "fully or partially blaming people for their

misfortunes" (Johnson et al., 2021, p. 1027), even when this blame is unjust due to lack of any responsibility from the person affected. In the Muehlenhard et al. (1985) study, a significant interaction occurred regarding perceived justification of rape. In short, the men in the study perceived that John was significantly more "justified" in raping Mary when (a) she asked him out and (b) she went to his apartment. In other words there was a main effect of who initiated the date (him, her, or she hinted until he asked), a main effect of date activity (movie, apartment, and religious event), and a significant interaction between these two variables. These patterns were stronger when the men had higher scores of sexism, measured by the Attitudes toward Women Scale (AWS; Spence et al., 1973). The purpose of our study was to replicate Muehlenhard et al. (1985) to see if the same pattern of results will occur now, over three decades later. We also added several additional variables to extend the findings and explore whether perceived justification of sexual activities without consent is correlated with factors such as demographics and beliefs about gender and sexual assault.

Changing Perceptions Over Time

As reviewed above, there is legal evidence that societal perceptions of sexual assault and rape have changed over time (e.g., changing definitions of rape, changing rates of the crime being reported). These changes can also be seen in psychological research. For example, in many studies completed between 1985 and 2022, topics such as "date rape" and "victim blaming" have focused on attitudes and perceptions. One study was the first to establish the now well-known statistic that one in four girls or women will experience attempted rape in their lifetime (Koss et al., 1987). This study was also instrumental in changing many people's perceptions that rapists are strangers; instead, they reported that rape perpetrators are much more likely to be people the victims know and trust.

About a decade later, a pioneering study focused on police officers' perceptions of date rape (Campbell, 1995). Conducted with officers from two different Midwestern police departments, Campbell found that victim blaming went down—and sympathy for victims went up—when officers (1) had more experience with rape cases, (2) found rape training helpful, and (3) noticed sexual harassment in their own workplace. This study showed that exposure to date rape statistics and circumstances can be helpful in decreasing victim blaming in general.

Later studies focused on how laypeople define date rape. For example, Verberg and colleagues (2001) asked 170 participants to write down a definition of date rape. The most common themes found in the written definitions centered on lack of consent, use of force, specific sex acts, and the context. Their analysis revealed that while many participants agreed that date rape is gender neutral, women's definitions of rape did slightly vary from men's. For example, while both men and women in their study noted that rape occurs when one person has not given consent, women's answers were more nuanced; they noted specific kinds of behavior that indicated consent or lack thereof. Women were also more likely to provide definitions of what constitutes "force" in this setting. Because this study established the benefit of including both men and women in research samples—so their attitudes and perceptions can be compared—the current study extended Muehlenhard et al. (1985) by inviting people of any gender to participate (recall that the original study only included male participants).

In the past several years, psychological research on victim blaming, rape myths, and other relevant topics has greatly increased (e.g., Bongiorno et al., 2019; Culda et al., 2018; Felson & Palmore, 2021; Gravelin et al., 2019). For example, individuals who endorse male dominance and patriarchal social systems show higher endorsement of rape myths and more victim blaming; the same results are found in participants who are low in empathy (Attreed & Kozlowski, 2019; Canto et al., 2017; Gul & Schuster, 2020; Rajiva, 2021). While these studies have added knowledge regarding perceptions of and attitudes regarding victim blaming for sexual assault, they have not directly replicated Muehlenhard et al. (1985). In addition, this study added several variables to extend their original work and tie it to these other more recent studies. Each variable of interest is briefly discussed next.

Factors That May Be Associated With Rape Perceptions

Level of Sexism

Muehlenhard et al. (1985) did measure levels of sexism and found that higher sexism in men was correlated with higher justification ratings for rape in fictional scenarios. More recent research has continued to explore how sexism influences rape perceptions. For example, some scholars suggest that types of sexism might matter. One study (Viki & Abrams, 2002) investigated benevolent sexism—defined as praise and acceptance of women who follow traditional gender norms. When they presented fictional rape vignettes (similar to the original Muehlenhard et al. [1985] study), they found that people who score higher in benevolent sexism blamed the victim more if she was married, compared to when her marital status was not mentioned. The authors suggested that being high in benevolent

sexism increased the likelihood of participants negatively viewing the victim and blaming her more because married women have stricter expectations placed on them than non-married women (e.g., being sexually faithful). Another study found that people who scored higher in hostile sexism—defined as negative attitudes toward women who violate traditional roles—fostered endorsement of rape myths and increased victim blaming (Rollero & Tartaglia, 2018). Specifically, this study found that higher endorsement of hostile sexist beliefs was correlated with endorsing rape myths such as the responses, "She asked for it" or "She lied." Finally, modern sexism—defined as justifying systemic privilege for men while denying it oppresses women—may also be a factor. For example, endorsement of modern sexist beliefs predicts rape victim blaming, especially among men (Ståhl et al., 2010). Sexism has thus been an enduring factor in predicting perceptions of rape. We used Muehlenhard et al.'s (1985) measure of sexism in the current study to compare the results reported in their study to those of modern participants.

Participant Sex

Muehlenhard et al. (1985) only included men in their sample, but many studies since then have compared perceptions based on participant sex. In another study using fictional scenarios of date rape between acquaintances, men were more likely to minimize the severity of rape, compared to women (Ben-David & Schneider, 2005), whereas women were more likely to have egalitarian attitudes about rape. A separate study showed that men found hypothetical sexual advances more acceptable than women did, especially if the aggressor was portrayed as physically attractive and/or of high socioeconomic status (Black & Gold, 2003). These and similar findings may reflect an in-group bias, in which men who read vignettes about male aggressors feel compelled to defend people in their own social group (see Tajfel, 1970, 1981). The current study used the original vignettes from Muehlenhard et al. (1985), in which the main dependent variable asks about whether John is justified in having sex with Mary "against her will." However, that study only included men, preventing any test of participant sex effects. We recruited participants of any gender to see whether this factor was associated with varying perceptions.

Participant Age

Another possible factor of victim blaming is age. Muehlenhard et al. (1985) used only undergraduate students who had an average age of 19 (no range or standard deviation was provided). But age might influence perceptions of rape. Many older people grew up when marital rape was not considered a crime (Rothman, 2015). Older people may also have been less affected by social media trends such as the #MeToo movement. That said, some research has found no differences in levels of victim blaming based on participant age (e.g., Adams-Price et al., 2004; Fakunmoju et al., 2015). We invited participants of any legal age (i.e., 18 or older) for the current study to explore whether it was associated with perceptions.

Rape Myth Endorsement

Rape myths are defined as false beliefs about rape, perpetrators, and victim such as "the victim must have asked for it" (for a review, see Lonsway & Fitzgerald, 1994). Such rape myths could possibly lead to victims downplaying sexual assaults, even to the point of denying they have been victimized or avoiding labels such as "assault" or "rape" (Wilson & Miller, 2016). In short, endorsing rape myths often provides more empathy for the perpetrator than for the victim, leading to victim blaming. Studies have shown that men are more likely to endorse rape myths, compared to women, and that observers are more likely to blame victims if the victims have been drinking alcohol or if they violate traditional gender roles, such as being sexually aggressive (for a review of many studies, see Grubb & Turner, 2012). The addition of a rape myths scale was included in the current extension of Muehlenhard et al. (1985) to see if endorsement of rape myths was correlated with victim blaming.

Belief in a Just World

Another factor potentially tied to victim blaming is belief in a just world (Lerner & Simmons, 1966; Murray et al., 2005). Belief in a just world is the idea that good things happen to good people, and bad things happen to bad people. Many scholars have found evidence that these beliefs are associated with more victim blaming in cases of rape and sexual assault (e.g., Furnham, 2003; Strömwall et al., 2012), including when participants read fictional vignettes (Breen & Boyce, 2018; Strömwall et al., 2013). The rationale is that victims of sexual assault somehow "deserved" what happened because they made bad choices (e.g., drinking, going to a location they should not have) or were somehow bad people, "asking for it" (Crall & Goodfriend, 2016). This study attempted to replicate this pattern, using the original Muehlenhard et al. (1985) vignettes but adding a measurement of belief in a just world.

Social Desirability

Social desirability is when an individual does something or presents themselves in a given way to be more likeable to society (Crowne & Marlowe, 1960). Social desirability can possibly be a factor in studies on victim blaming in two ways. First, an observer's opinion may change to blame a victim or alleged perpetrator if they perceive that person has support from others (Pinciotti & Orcutt, 2017). Second, participants in research studies who are high in social desirability needs may change their answers to match what they believe researchers want them to say—a form of demand characteristics (Nichols & Maner, 2008; Orne, 1962). On the other hand, some research has found that social desirability does not predict amount of victim blaming (Ståhl et al., 2010). The current study included a measure of social desirability with the goal of adding to this unresolved question in the literature.

Hypotheses

Based on the research reviewed above, we proposed the following hypotheses. Hypothesis 1 is a direct replication of Muehlenhard et al.'s (1985) main result: Participants will report that John is more "justified" in having sex with Mary "against her will" when (a) she initiated the date and (b) they went to his apartment. While the authors believe perceptions may be different now, compared to 1985, this pattern of results was tested to replicate the original study. Hypothesis 2 focused on replicating the original study's findings regarding sexism plus the additional variables we added to extend the original work. Specifically, we expected that justification scores would be higher when participants (a) are male, (b) scored higher in sexism, (c) are older, (d) endorse rape myths more, (e) believe more in a "just world," and (f) scored higher in social desirability.

Method

Participants

There were 251 participants (68 men, 181 women, 2 other) whose age ranged from 18 to 75 years old (M = 27.13, *Median* = 21.00, SD = 12.05). Participants were mostly White (91%) with a few who identified as Latinx/Latine/Hispanic (5%), Black/African American (2%), or mixed/other (2%). Participants were solicited through class announcements (usually in exchange for extra credit) and through social media posts (for no compensation other than thanks). While the consent form explicitly required participants to be over the age of 18, two participants completed the survey and indicated they were 17. A third participant declined to provide their age. To ensure that all participants were legally able to give consent, these three participants were removed from all analyses (leaving the 251 participants described above).

Independent Variable: Vignettes

Participants were randomly assigned to read one of nine vignettes, replicating Muehlenhard et al. (1985). The vignettes described a first date scenario with two factors that changed in each one: 1) who asked whom – John asked Mary, Mary asked John, or Mary hinted that she was free, and John asked, and 2) where they went – to the movies, John's apartment, or a religious event. An example is: *"John and Mary are in psychology class together and talk with each other occasionally. After class one day, he asked her out for Saturday night. They went to a religious function."* The two changing factors created a 3 (who asked whom) X 3 (date activity) factorial design.

Dependent Variable: Justification Ratings

After reading their vignette, each participant answered 14 questions regarding date rape scenarios, again replicating how Muehlenhard et al. (1985) measured a global perception of sexual activities perpetrated by one person without the other person's consent. Seven questions were based on what sexual activities (e.g., kissing, touching of genitals or breast, sexual intercourse) Mary should "expect" from John. The remaining seven questions asked what sexual activity John would be "justified" in doing if Mary did not want to. Participants were asked to rate each item on a 7-point Likert-like scale ranging from (1) *definitely not* to (7) *definitely*. The key question was, "Is John justified in having sexual intercourse with Mary if she doesn't want to?" This single item was the one analyzed in Muehlenhard et al. (1985) for their main results. The other 13 items were also a replication of the original study and were averaged to create a composite score measuring the overall "justification" scores for behaviors from John which were less severe (but still without Mary's consent). Both variables had a possible range from 1 to 7, with higher numbers indicating that John was more "justified."

Additional Variables

Level of Sexism

Participants were asked to agree or disagree with 16 statements to measure their level of sexism using the Attitudes toward Women Scale (Spence et al., 1973). For example, "Sons in a family should be given more encouragement to go to college than daughters." Responses were given using a 4-point Likert-like scale where 1 = *disagree strongly* and 4 = *agree strongly*. The version of the scale used in this study originally had 25 items, but nine of the items were excluded due to

accidentally not being included in online software programming (leaving the 16 we used). Despite this error, internal consistency for the scale was still good, $\alpha = .77$. Half of the items were reversed-scored, then all were averaged to create a composite variable where higher scores indicate more sexism (possible range is 1-4).

Rape Myth Acceptance

Participants also completed the Rape Myths Acceptance Scale (McMahon & Farmer, 2011), which includes 19 items on a 5-point Likert-like scale (where 1 = *strongly disagree* and 5 = *strongly agree*). For example, "If a girl goes to a room alone with a guy at a party, it is her own fault if she is raped." All items were averaged and higher scores indicate greater acceptance of rape myths (possible range is 1-5). Internal consistency was good, $\alpha = .91$.

Belief in a Just World

Participants also completed a scale measuring belief in a just world (Rubin & Peplau, 1975). There were 20 statements (e.g., "By and large, people deserve what they get") and participants responded on a 6-point Likert-like scale where 1 = *strongly disagree* and 6 = *strongly agree*. Half of the items were reverse-scored, then all items were averaged such that higher scores indicate more belief in a just world (possible range is 1-6). Internal consistency was medium, $\alpha = .69$.

Social Desirability

Participants also took a social desirability survey (Crowne & Marlowe, 1960). It consisted of 12 items; for example, "I'm always willing to admit it when I make a mistake." For this study participants responded to each statement on a 6-point Likert-like scale where 1 = *absolutely false for me* and 6 = *absolutely true for me*. Half of the items were reverse-coded, then all items were averaged such that higher scores indicate greater need for social desirability (possible range is 1-6). Internal consistency was medium, $\alpha = .58$.

Procedure

All participants accessed the online survey through the PsychData.com website. The consent form explicitly and clearly noted that participants had to be at least 18 years of age; no other criteria were required. After reading informed consent materials and indicating their consent, they provided basic demographic information. Next, they read their vignette and provided responses regarding perceptions of John and Mary. They then completed all the additional variable scales described above and concluded with debriefing information. Participants were given the ability to skip any question if they preferred not to answer. If the participant wanted extra credit, they were given a link to a separate survey where they could provide their name. This study was approved by the hosting university's Internal Review Board for ethics.

Results

Hypothesis 1: Replication

Hypothesis 1 was tested using the main dependent variable of justification ratings for John "having sex with Mary if she doesn't want to" (i.e., rape). In Muehlenhard et al.'s (1985) study, justification scores were significantly higher for vignettes in which Mary asked out John and when they went to John's apartment. To test whether our participants replicated this pattern, we conducted two analyses of variance, checking for interactions and main effects of the date circumstances (the same strategy used in the original paper).

The first test focused on the single item about John "having sex" with Mary without consent. This ANOVA tested for main effects of who initiated the date and the date activity, as well as their interaction, on justifications for rape. Across the entire sample, ratings were low ($M = 1.04$) but there was a range from 1.0 to 5.0 ($SD = .33$). The overall model showed no significant effects, $F(8, 238) = 1.00$, $p = .43$. Neither the interaction ($p = .59$) nor either of the main effects ($p = .18$ for who initiated the date and $p = .29$ for date activity) were statistically significant.

We also tested justification ratings for the less severe actions John might take. This dependent variable was the average of the other 13 items included in the original Muehlenhard et al. (1985) study regarding what Mary might "expect" from John and what he might do to Mary (e.g., kissing or touching her breasts) without consent. The ANOVA again tested for main effects of who initiated the date and date activity, as well as their interaction, on justification scores. Again, across the entire sample, ratings were low ($M = 1.28$) but did vary ($SD = 0.42$). Even for these less severe behaviors, modern participants agreed that they were not justified regardless of who initiated the date or where the dating activity occurred. The overall model showed no significance, $F(8, 242) = 0.75$, $p = .65$. Again, neither the interaction ($p = .41$) nor either of the main effects ($p = .76$ for who initiated the date and $p = .55$ for date activity) were statistically significant.

In sum, we did not replicate Muehlenhard et al.'s (1985) original results. Thirty-five years later, participants presented with the same scenarios did not indicate that rape was justified, regardless of the circumstances included in this study.

Hypothesis 2: Extension

We also extended Muehlenhard et al.'s (1985) study by adding several variables we expected to be associated with higher justification for John (in other words, higher victim blaming). The original study included levels of sexism; we added (a) participant sex, (b) age, (c) endorsement of rape myths, (d) belief in a just world, and (e) social desirability scores. Each variable was tested for how it was associated with the 13-item composite variable regarding John's justification for less severe sexual behaviors (e.g., kissing). Tests were conducted on the composite variable instead of the single item measuring rape because responses on the composite variable indicated more of a range of perceptions.

For participant sex, men had both higher justification scores (M = 1.47) and a greater variance (SD = 0.61) compared to women (M = 1.21, SD = 0.29). The variances were significantly different from each other (p < .001) so we ran an unequal variances t-test. This test revealed a statistically significant difference between men and women, $t(78) = 3.36$, p = .001. Men were therefore more likely to say that John's actions were "justified," compared to women.

The other five variables were all continuous and were tested via correlations. The mean level of sexism for this sample was 1.50 (SD = 0.34). The mean for rape myth acceptance was 1.78 (SD = 0.59). The mean for belief in a just world was 3.38 (SD = 0.49). Finally, the mean for social desirability was 3.64 (SD = 0.58). As reported above, the mean for age was 27.13 years ($Median$ = 21.00, SD = 12.05).

Three of the six variables included in this study had significant associations with justification scores: sexism (r = .13, p = .043), belief in rape myths (r = .20, p = .004), and [as mentioned earlier] participant sex ($t[78] = 3.36$, p = .001). In other words, at least in this sample, more sexism, more belief in rape myths, and identifying as male were associated with higher justification scores. The remaining three variables showed no significance. Social desirability (r = -.13, p = .062), belief in a just world (r = .00, p = .983), and participant age (r = .03, p = .676) did not reach statistical significance. Thus, Hypothesis 2 was partially supported.

Discussion

Our first hypothesis was a direct replication of the classic Muehlenhard et al. (1985) finding that people find fictional scenarios of rape between a man and woman more "justified" when (a) she initiated the date and (b) they went to his apartment. This hypothesis was not supported. It appears that modern participants (on average, at least) do not perceive that date rape is "justified" in any of the circumstances included in this study. The authors of the current study believe that Muehlenhard et al.'s (1985) original findings were valid, but we hope the lack of replication reflects a cultural shift. Social norms against victim blaming are reflected in movements such as #MeToo, created in 2006 by Tarana Burke (Gill & Rahman-Jones, 2020). This movement increased awareness of women being sexually abused. This kind of awareness has been shown to decrease victim blaming (Campbell, 1995). In addition, definitions of "rape" have changed from 1985. For example, the federal definition of the crime now includes the word "forcible" (United States Department of Justice, 2012). Language and social norms may have dually influenced general perceptions of crimes and decreased victim blaming.

Our second hypothesis was an extension of the original Muehlenhard et al. (1985) study. We included several additional variables as possibly associated with degree of victim blaming when the measure of victim blaming included not just rape itself but other, less severe (but still problematic) behaviors (e.g., unwanted kissing or sexual touching). This hypothesis was partially supported, identifying some variables that were associated with more blaming (and some that were not). Variables that reached statistical significance were sexism (which was also identified in the original Muehlenhard et al. [1985] study), participant sex (men provided higher justification scores than women), and belief in rape myths. Social desirability, belief in a just world, and participant age were not associated with degree of justification.

Muelenhard's original study only included men in the sample. Our finding that men provided higher justification scores than women did may reflect either different perceptions by sex (e.g., Ben-David & Schneider, 2005; Black & Gold, 2003) or some kind of ingroup protective bias (Tajfel, 1970, 1981). The nonsignificant variables were social desirability, belief in a just world, and participant age. Further work is needed to sort out how these variables may (or may not) be a factor in victim blaming.

Other studies have also found that victim blaming is not correlated with age (Adams-Price et al, 2004; Fakunmoju et al, 2015), so this study adds further support to this trend. On the other hand, our results do not align with previous research that has found a connection between victim blaming and belief in a just world (e.g., Breen & Boyce, 2018; Furnham, 2003; Strömwall et al., 2012, 2013). Further research should attempt to clarify the nuances of this possible connection.

Strengths, Limitations, and Future Research

We both replicated and extended the classic Muehlenhard et al. (1985) study. While some aspects of the original findings were not found in our study, it is unclear whether the lack of replication is due to some kind of procedural alteration or because cultural attitudes have changed over the last few decades. It is also possible there was error in the original study. Still, the current study adds to the literature by including several additional variables that were associated with degree of victim blaming. Victim blaming is still a critical social issue, and research helping understand it may also help survivors feel validated and valued.

A limitation of our study is that we used the same language in the fictional scenarios and dependent variables from Muehlenhard et al. (1985). This meant that one of the main outcomes was based on a single item in the study (if John was justified in "having sex" with Mary "against her will"). These limitations could be addressed in future research that alters and adds to the wording of the questions and the types of fictional vignette offered. For example, vignettes could include female perpetrators and male victims, or same-sex assault scenarios. Past work on masculinity norms includes the idea that men cannot be raped (e.g., Iwamoto et al., 2012). Riccardi (2010) discussed four male survivors who refused to discuss their rape due to fear of losing "manliness." Future vignettes could also include additional details previously shown to affect witness perceptions, such as those measured by Black and Gold (2003) regarding whether the perpetrator's touch was "gentle" and the socio-economic status of the characters observed.

Similarly, we also used the same scale to measure sexist attitudes and beliefs as Muehlenhard et al. (1985). One important limitation is that nine items from the version of the Attitudes Toward Women scale we used (Spence et al., 1973) were accidentally left out of our survey due to experimenter error in programming the online software. Our alpha level for the 16 remaining scale items was still decent (α = .77), but it is possible that the briefer version did not fully capture nuances of belief that are usually measured by this scale. Other studies have found that the AWS scale measures a unitary construct (e.g., Whatley, 2008). In addition, there are several scales that measure more modern attitudes about gender roles and norms which might be more relevant to a college sample today. For example, many studies done in the last several decades have included scales measuring hostile and benevolent sexism, as defined earlier in this paper (see Glick & Fiske, 1997, 2001). These scales might capture more modern views of gender roles and attitudes. Future research could use these additional scales to gain further insight into specific types of sexism and how they are differentially related to victim blaming in sexual assault scenarios.

Replicating the positive correlation between sexism and victim blaming shows that this association remains in modern culture. Other studies have found the same pattern (e.g., Rollero & Tartaglia, 2018; Ståhl et al., 2010; Viki & Abrams, 2002). Similarly, endorsement of rape myths was positively correlated with victim blaming. Other studies have found endorsement of rape myths such as "she asked for it" and the attitude that assault perpetrators sometimes deserve more empathy than their victims (see Rollero & Tartaglia, 2018; Wilson & Miller, 2016). Many of these studies, including the current study, need to do a better job of explicitly defining relevant constructs and studying how they do and do not overlap in terms of both measurement and meaning. Both convergent and discriminant validity are important to fully understand what drives attitudes and responses to sexual assault and rape. In addition, because this finding is only correlational, causal implications cannot be drawn. Future work should employ randomized experimental designs to further understand any causal connections among variables.

It is also an important limitation that the main dependent variable (victim blaming, or "justification" for rape) theoretically overlaps quite a bit with the measurement of rape myth endorsement. Thus, correlations between these two constructs need careful consideration regarding exactly why one is associated with the other and if there is meaningful difference between the two variables. In addition, two of the scales (social desirability and belief in a just world) had only medium internal consistency, indicating the possibility that participants found the survey items unclear or answered items inconsistently within those constructs. As noted in the previous paragraph, overlapping constructs were an important limitation in this study. Future work might want to complete exploratory factor analyses on these scales to understand how and why conceptual overlapping of ideas occurs and could be an important contribution to the literature on these topics.

Finally, some concern is based on participant demographics and how these were measured. The survey started by asking participants about their demographics (e.g., age, sex) which may have primed them to think about these constructs before completing the rest of the survey; order effects may have therefore been at play. At least two participants took the survey who were not of legal age, violating the agreement on the consent form (they were eliminated from analysis), and it is possible

that non-U.S. residents took the survey if they saw the link on social media posts. Future work should be more careful in recruiting to ensure that everyone in the sample is legally able to participate; the study tasks could also be randomly assigned to avoid order effects.

Conclusion

Through a replication and extension of a classic study, the present work (conducted in 2021/2022) examined perceptions of victim blaming in sexual assault scenarios in an attempt to see whether they were different now, compared to findings reported in Muehlenhard et al. (1985). Some results indicated promising social trends: Overall, results revealed that most modern participants did not believe a fictional man was "justified" in raping a woman under any circumstances (at least, in none of the circumstances included in this study). However, further investigation did find some nuance. When less extreme—but still unacceptable—behaviors were considered (such as kissing or fondling her without her consent), attitudes were more variable. Specifically, justification scores were higher in men and in participants who had higher sexist beliefs and endorsed rape myths. These results indicate that future research is needed to help understand the nuances of victim blaming, ideally to end it from happening. That said, cultural progress that empowers survivors and reduces victim blaming is encouraging.

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Author Note

Correspondence may be addressed to: Wind Goodfriend, Ph.D., Psychology Department, 610 W. 4th Street, Buena Vista University, Storm Lake, IA 50588, email goodfriend@bvu.edu, telephone 712-749-2108.

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THE IMPACT OF JOB MOTIVATION AND NON-CLINICAL DEPRESSION ON JOB BURNOUT DURING THE COVID-19 PANDEMIC

MAJA A. PERSA & JISOOK PARK

FORT HAYS STATE UNIVERSITY

Abstract – The COVID-19 pandemic brought significant distress to many individuals and caused substantial changes in their lives. Anecdotal and statistical evidence indicates decreased job motivation and significant job burnout in recent years. Based on existing job burnout literature, the current study attempts to expand our understanding of the influence of job motivation on job burnout in relation to depression during the COVID-19 pandemic. Specifically, the study examined the effect of different types of job motivation on job burnout. In addition, we examined the role of non-clinical depression as a moderator between job motivation and job burnout. We recruited participants (119 men and 111 women) through the Amazon Mechanical Turk for this study. Results showed higher extrinsic motivation predicting higher job burnout in general and, as expected, higher intrinsic motivation predicted lower job burnout. However, identified regulation motivation did not predict job burnout. Finally, results showed that non-clinical depressive symptoms moderated the influence of intrinsic motivation on job disengagement. Overall, these findings highlight the important role of job motivation and the influence of mental health on job burnout.

Keywords: job burnout, job motivation, non-clinical depression

The COVID-19 pandemic brought distress and anxiety to many people and caused significant changes to their daily lives, including individuals' job performance and job expectations. As they navigated these unprecedented challenges, it is reasonable to believe employees' job-related stress has increased, as has their home-life stress and personal issue-related stress (e.g., mental and physical health). Anecdotally, many employees have shared significant feelings of job burnout and lack of motivation on social media posts since the start of the pandemic. For example, in a *TIME* magazine survey, people reported hating their jobs, being unhappy with work, performing below their usual productivity level, and feeling sad or depressed (Lipman, 2021). Adverse work claims have been supported by recent statistics as well. In a recent survey conducted by the American Psychological Association (APA), 59% of workers experienced job-related stress in the past months due to the pandemic and planned to leave their current jobs (Reinberg, 2021). In 2021, nearly 39 million Americans handed in job resignations (Chen & Smith, 2021). Although there were multiple reasons for these resignations, a plethora stemmed from overworking due to COVID-19, stress linked to the pandemic, and powerful feelings of job burnout. Job burnout is a well-researched topic as it relates to lower job satisfaction (Maslach, Schaufeli, & Leiter, 2001), job turnover (Harnois & Gabriel, 2000), and lower life satisfaction (Harnois & Gabriel, 2000). The current study is particularly interested in investigating how different job motivations predict job burnout during the COVID-19 pandemic. Furthermore, the present study aims to elucidate the impact of non-clinical depression on the relationship between intrinsic motivation and job burnout.

Job Exhaustion and Job Disengagement

Job burnout is more than simply losing interest in a job. Instead, this psychological construct can result from chronic interpersonal stressors on the job. Employees may display multiple behavioral and attitudinal changes toward work when experiencing job burnout. Regarding multiple dimensions of job burnout, this study will focus on exhaustion and disengagement at work.

Individuals who experience job burnout can experience physical tiredness and diminished interest in their work. This study's first symptom of job burnout is

exhaustion, and the second is job disengagement. Both exhaustion and disengagement are subtypes of job burnout, but distinct differences exist between these two classifications. Exhaustion refers to the diminishment of emotional and mental energy due to extended exposure to job demands, especially when ideal resources are missing to cope with job demands (Moore, 2000). Humans have a limited number of resources to invest. Humans manage with the remaining supply as resources are expended to avoid burnout. Cognitive resources are used to self-regulate and focus on the productivity and positive aspects of being at a job. However, when all the cognitive resources are exhausted, individuals eventually feel emotional exhaustion (Thanacoody et al., 2014). Though there are individual variations, exhaustion tends to increase with job demand (Rijk et al., 1998).

Disengagement is not a depletion of resources but rather a distancing of oneself from work due to a lack of "fit" between a worker and the work that needs to be performed (Demerouti, Bakker, et al., 2001). Given a scenario where there is a negative relationship between work and workers, individuals will not be fully committed to completing job demands. This outcome can result in further distancing from the work, and this process is known as disengagement. While in this negative cycle, individuals tend to develop negative attitudes toward their work. Past studies suggest varying degrees of exhaustion and disengagement among workers depending on their protective factors, including job motivation (Kotera et al., 2018).

Job motivation can either contribute to or break the negative cycle of long-term effects of job burnout (Brummelhuis et al., 2011). For example, employees' inherent interest in the job is often a strong protective factor against a negative job burnout cycle. Understanding the experienced dimensions of job burnout as they relate to individual job motivations may bring industrial-organizational psychology literature closer to conceptualizing specific people who experience only minimum levels of job burnout even during a pandemic. The following section discusses various types of job motivations related to job burnout.

Job Motivation

Motivation is commonly defined as the bridge between goals and the appropriate behavior to achieve them, and the APA describes it as "the desire or willingness to make an effort in one's work" (n.d.b.). In this context, motivation helps explain human behavior. However, motivation is not fixed or crystallized but rather fluid throughout different times in people's lives. According to self-determination theory (SDT), people have basic needs for connection, autonomy, and competence (Ryan & Deci, 2000b). Individuals have varying needs, and the goal to fulfill these three needs can explain various types of motivation. In this theoretical context, SDT distinguishes extrinsic and intrinsic motivation on a continuum and describes its effects based on individuals' internal resources, indicating motivation can vary in the degrees that it is internalized (Gagné & Deci, 2005). For example, individuals' motivation to change may vary depending on their autonomy and internalization of resources, which the APA describes as a process in which the characteristics of outside factors or attitudes of individuals become assimilated into the self and adopted as one's own (n.d.a.). Intrinsic motivation in a work setting occurs when individuals autonomously complete a job that corresponds with their personal beliefs, feelings, and attitudes. On the other hand, extrinsic motivation is affiliated with pressure, expectations, and control from external variables, and motivation is detached from complete personal enjoyment (Ryan & Deci, 2000a). When individuals feel they have the freedom to complete a task and naturally experience enjoyment in the process, high intrinsic motivation can help fight against job burnout. Individuals with higher intrinsic motivation have more personal resources of self-esteem, resiliency, and well-being and are better protected from job burnout than individuals with extrinsic motivation (Brummelhuis et al., 2011). On the other hand, extrinsic motivation is a more passive approach to task completion, and it can induce conflict or provoke anxiety. Consequently, individuals driven by extrinsic motivation typically need to exert more significant effort to control their negative emotions. Extrinsically motivated people, in general, show less engagement in work and lack personal resources. They are more likely to adopt a negative view, making it more difficult to recover from work-related burnout. In the current study, three types of job motivation were selected to represent conceptually and systematically different motivation types according to the self-determination theory of motivation (Ryan & Deci, 2000b): extrinsic regulation, identified regulation, and intrinsic motivation.

Psychologists describe a subtype of extrinsic motivation, called extrinsic regulation social, as a type of extrinsic motivation where individuals are motivated by approval from other people. Humans are profoundly social beings who desire to connect with others (Mildner & Tamir, 2021). Considering that social interactions are purposeful for fulfilling social needs, emphasizing social acceptance and social rewards may be significant. When there is a lack of fit between the worker and workplace social environment, workers can easily experience job

disengagement or job exhaustion, because rewards solely contingent on external acceptance or social approval can be more exhausting than inherent interest in the task. Another subtype of extrinsic motivation is identified regulation. Though identified regulation is a subtype of extrinsic motivation, according to Gagné & Deci (2005), identified regulation is qualitatively different from extrinsic motivation. Individuals with high levels of identified motivation enjoy the value of the behavior for personal goals, not just external goals, as is the case with extrinsic motivation. As a result, individuals with high identified regulation motivation experience greater autonomy in their jobs because their behavior motives align with their personal goals and identities (Gagné & Deci, 2005). Identified motivation is more self-determined and associated with more remarkable persistence and social functioning than external motivation (Zhang et al., 2016). A study found a positive, long-term impact of identified motivation on educational performances though it was much smaller than the impact of intrinsic motivation (Liu et al., 2019). Studies suggest that though some benefits from identified motivation may be true, they will be short-lived. Therefore, our study predicts that identified motivation will lead to higher exhaustion and disengagement when compared to intrinsic motivation, but not as high as extrinsic motivation.

The relationship between motivation and job burnout has been well-documented in literature, seen through works like Fernet et al. (2017). An emerging body of research suggests that the quality of employees' motivation may expose them to varying degrees of job stress and burnout (Fernet et al., 2017) and its impact on their well-being (Brummelhuis et al., 2011). The current study aims to expand our understanding of this relationship by comparing the role of different types of motivation related to individuals' mental health and job burnout, especially non-clinical depression, during the COVID-19 pandemic. Job-related stress and worsening mental health are increasingly common due to the COVID-19 pandemic (Denning et al., 2021).

Mental Health

Mental health plays a crucial role in the way people think, feel, and behave. Likewise, mental health impacts how individuals handle stress and motivation at work, and mental health problems are relevant to many employees. Mental health problems are among the leading causes of disease and disability, regardless of country, income, or culture (Harnois & Gabriel, 2000). Although it is difficult to quantify the impact of work alone on personal attributes, most mental health professionals agree on the critical influence the workplace has on the individual's mental well-being (Harnois & Gabriel, 2000) and vice versa (Maslach et al., 2001).

Li (2020) analyzed the influence of psychological capital, or psychological resources someone possesses to impact work positively, and found a significant correlation between mental health and job burnout. Kotera et al. (2018) found that extrinsic motivation was more strongly related to mental health attitudes and problems than intrinsic motivation. Furthermore, there was a correlation between work motivation and mental health attitudes, implying that extrinsically motivated individuals typically feel more shame associated with mental health problems than intrinsically motivated people.

Mental health also promotes positive inner functioning and healthy relationships with others and the community to which one belongs (World Health Organization, 2004). Those that are mentally healthy may be less susceptible to exhaustion from work, a factor of job burnout (Maslach et al., 2001). Mentally healthy people present positive emotions that may serve as resources to combat the emotional and mental depletion of energy called exhaustion. Regarding the disengagement factor of job burnout, studies about depression are valuable in connecting poor mental health and detachment. Depressed people experience greater pessimism and a tendency to disengage from goal pursuits (Dickson et al., 2016). Thus, poor mental health contributes to a decline in goal motivation and greater disengagement.

Overview of the Current Study

It is reasonable to say numerous individuals experienced unprecedented stress levels during the pandemic, which could have led more people to experience job burnout across the population. We predict that the degree of job burnout depends on the type of job motivation. In addition, we expect individuals' mental health, measured by non-clinical depression, to moderate the influence of job motivation on job burnout. The current study investigates intrinsic, identified, and extrinsic motivation to encompass varying levels of job motivation individuals hold, aiming to detail how each unique factor operates in human functioning, such as burnout. The differing levels of autonomy and internalization between these types of motivation have the potential to guide feelings that may relate to a low or high threshold to experiencing job burnout.

Hypotheses

According to self-determination theory, extrinsic regulation, identified regulation, and intrinsic motivation

utilize different levels of autonomy. Therefore, the amount of required external resources to keep the balance between the drive to maintain the behavior level and the positive reward received due to the behavior differs across three types of motivation. Intrinsic motivation supports a strong person-job fit and natural enjoyment. Intrinsic motivation will predict lower levels of disengagement and exhaustion even during the pandemic because of personal pleasure and the consistent resources applied toward work. On the other hand, extrinsic motivation will predict higher levels of disengagement and exhaustion, especially during the pandemic, because of low autonomy, limited personal resources, and weak worker-job fit. Identified regulation motivation is still rooted in self-determination and social functioning (Zhang et al., 2016). Thus, we predict that identified regulation motivation will predict high levels of disengagement and exhaustion but not as high as extrinsic regulation social motivation.

H1-a: High levels of extrinsic regulation social will predict high levels of disengagement.

H1-b: High levels of identified regulation will predict high levels of disengagement but not as high as extrinsic regulation social.

H1-c: High levels of intrinsic will predict low levels of disengagement.

H2-a: High levels of extrinsic regulation social will predict high levels of exhaustion.

H2-b: High levels of identified regulation will predict high levels of exhaustion but not as severe when compared to extrinsic regulation social.

H2-c: High levels of intrinsic motivation will predict low levels of exhaustion.

Even though intrinsic motivation will protect individuals from experiencing severe levels of job burnout, if they have high levels of depression, we predict they will still experience job burnout. Thus, we expect to see a moderation effect between non-clinical depression and intrinsic motivation on job burnout (both disengagement and exhaustion). Non-clinical depression is one aspect of poor mental health; similarly, its effects are expected to be related to exhaustion and disengagement. Symptoms of exhaustion include loss of emotional attachments and reduction in gratification. Symptoms of disengagement include negative expectations and indecisiveness (Beck & Alford, 2014). The negative impact of depression is thought to be more severe on exhaustion than disengagement because there is already a depletion of energy and resources connected to exhaustion.

H3-a: Mental health will have a moderating effect between intrinsic motivation and disengagement.

H3-b: Mental health will have a moderating effect between intrinsic motivation and exhaustion.

Method

Participants

A total of 232 participants (119 men, 111 women, 2 NA, M_{AGE} = 37.03, *SD* = 10.56, Age range = 20-70) were recruited from an online survey administration system, Amazon's Mechanical Turk (MTurk). A breakdown of sample characteristics can be viewed in Tables 1 and 2. MTurk's design allows market researchers in the United States to conduct research, and in return, participants receive a small amount of money. For participation in the current study, participants were compensated $0.25. The use of MTurk allowed a wider variety of ethnicities, locations, and ages to participate in the study compared to those present at Fort Hays State University. The pool of MTurk subjects is representative of the public and has similar qualities to other convenience samples (Berinsky et al., 2012). Participation was voluntary, anonymous, and flexible, with the option to stop participation at any time. All participants, as well as data collection and maintenance, were treated in accordance with ethical guidelines outlined by the APA and the Institutional Review Board.

Instruments

Job Burnout

To assess job burnout, the *Oldenburg Burnout Inventory* was used (Demerouti, Mostert, & Bakker, 2010). The questionnaire focused on 16 items rated on a 4-point Likert scale (1 = strongly disagree; 4 = strongly agree) such that higher scores indicated higher levels of job burnout. Eight items were related to the exhaustion dimension of job burnout. A few example items include "I can tolerate the pressure of my work very well (reserve code)," and "When I work, I usually feel energized (reserve code)." An additional eight items were related to the disengagement dimension. A few example items include "This is the only type of work that I can imagine myself doing," and "It happens more and more often that I talk about my work in a negative way." Cronbach's Alpha coefficients for the current sample were .76 and .70 for disengagement and exhaustion, respectively, indicating adequate scale reliability.

Table 1
Demographic Information

Ethnicity	N	Education	N	Income	N	Employment status	N
White	175	High school	20	less than $25,000)	16	Unemployed	7
Black	25	Associate degree	18	$25,000 - $49,999	64	Employed, part-time	45
Asian	20	Bachelors	92	$50,000 - $114,999	114	Employed, full-time	178
Hispanic	9	Graduate studies	40	$115,000 - $249,999	36	Retired	1
Native Hawaiian	1	MBA/MA/ MS	58	$250,000 or more	1	Missing	1
Missing	2	J.D./ Ph.D./ Ed. D/ M. D.	4	Missing	1		
Total	232	Total	232	Total	232	Total	232

Table 2
Additional Demographic Information

Decrease in Income during COVID-19 Pandemic		Current Residence	
Yes	145	Urban	197
No	86	Rural	35
Missing	1		
Total	232	Total	232

Job Motivation

The *Revised-Motivation at Work Scale (R-MAWS)* (Gagné et al., 2010) was used to assess three types of job motivation: Extrinsic regulation social motivation (Cronbach's Alpha = .75), identified regulation motivation (Cronbach's Alpha = .83), and intrinsic motivation (Cronbach's Alpha = .81). Each item's rating was on a 7-point Likert scale (1 = not at all; 7 = completely), and higher scores in each section matched higher relatedness to the specific type of motivation. Multiple statements assessed three types of motivation. For example, “To avoid being criticized by others (e.g., supervisor, colleagues, family, clients…)” was used to measure extrinsic regulation social; “Because putting efforts in this job aligns with my personal values” measured identified regulation motivation; and “Because I have fun doing my job” assessed intrinsic motivation.

Non-clinical Depression

The *Revised-Patient Health Questionnaire-9 (PHQ-9)* includes nine items assessing self-reported depression levels (Swartz et al., 2007) on a 4-point Likert scale (0 = not at all, 4 = nearly every day). PHQ-9 is a widely used non-clinical depression screening tool based on DSM-IV guidelines (Manea et al., 2015). Higher scores were related to higher depressive feelings and corresponded to more mental health concerns. In order to assess individuals' non-clinical depression since the start of the COVID-19 pandemic, questions were modified to include a specific time frame of the experience of depression, such as, "Little interest or pleasure in doing things since the start of the COVID-19 pandemic." A composite score was created by averaging the responses to all the questions. Cronbach’s Alpha for the current sample was .93.

Results

Initial examination of job burnout data indicated a positive correlation between all pairs of variables. However, the correlation between the predictor variables,

extrinsic social regulation, identified regulation, and intrinsic motivation, as indicated by correlational coefficients *r* ranging between .52 and .69 did not indicate extremely high multicollinearity.

The overall multiple regression to predict job disengagement from three predictors was statically significant, R^2 = .21, F (3, 228) = 20.18, p < .001. Extrinsic social regulation was significantly predictive of disengagement (β = .35, t (226) = 4.72, p < .001), as well as intrinsic motivation (β = -.49, t (226) = -5.80, p < .001). However, identified regulation was not a significant predictor (β = -.09, t (226) = -.99, p = .32).

The overall multiple regression to predict job exhaustion from three predictors was statistically significant, R^2 = .27, F (3, 228) = 28.08, p < .001. Higher extrinsic social regulation predicted more exhaustion (β = .51, t (226) = 7.26, p < .001), but higher intrinsic motivation predicted lower exhaustion (β = -.50, t (226) = -6.26, p < .001). Similar to the previous result, identified regulation was not a significant predictor (β = -.11, t (226) = -1.35, p = .18).

A regression analysis was performed to assess whether non-clinical depression interacted with intrinsic motivation using job exhaustion and job disengagement as criteria. Preliminary data screening did not suggest problems with violation of assumptions of normality and linearity. The overall regression was statistically significant, R^2 = .42, F (3, 228) = 55.89, p < .001. There was a significant non-clinical depression by intrinsic motivation interaction, β = .16, t (228) = 2.99, p = .003. In addition, both non-clinical depression (β = .50, t (228) = 9.09, p < .001) and intrinsic motivation (β = -.46, t (228) = -8.25, p < .001) predicted job disengagement. Because the interaction term was statistically significant, a simple slope analysis was performed to further analyze the moderation effect of non-clinical depression.

As shown in Figure 1, in the low non-clinical depression group, intrinsic motivation was a significant predictor of job disengagement, β = -.60, t (228) = -9.97, p < .001. In the high non-clinical depression group, as compared to the low group, intrinsic motivation was still a significant predictor of job disengagement, but a much weaker predictor, β = -.32, t (228) =-3.76, p < .001. This result shows that protection from intrinsic motivation is impacted even by non-clinical depression.

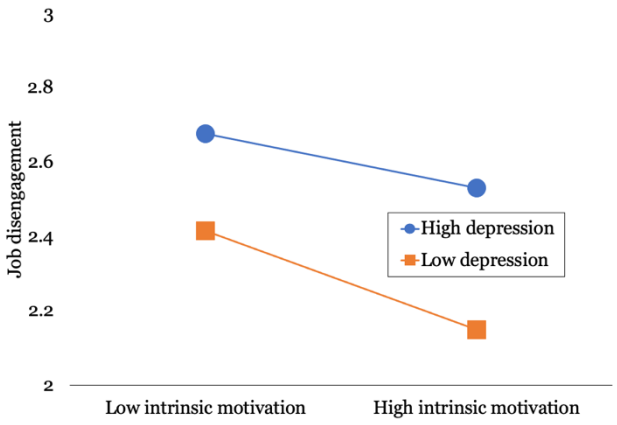
Lastly, a moderation analysis was performed to assess whether non-clinical depression interacted with intrinsic motivation when predicting job exhaustion. The overall regression was statistically significant, R^2 =.46, F (3, 228) = 65.82, p < .001. Non-clinical depression by intrinsic motivation interaction was not significant, β = .004, t (228) = .08, p = .94. There were significant effects, however, for non-clinical depression and intrinsic motivation when predicting exhaustion; β = .63, t (228) = 11.99, p < .001 and β = -.48, t (228) = -9.04, p < .001 respectively.

Discussion

The purpose of the current study was to examine the relationships between job motivation and job burnout under the self-determination theory's theoretical framework and investigate the influence of job motivation types on job burnout. SDT differentiates the degree of autonomy behind types of motivation, explaining that behavior is categorized in these terms (Gagné & Deci, 2005). Though job burnout is unavoidable, individuals experience varying degrees of job burnout depending on types of motivation at work.

The current study confirms previous studies that intrinsic motivation predicts lower exhaustion and disengagement. On the other hand, extrinsic motivation, especially socially driven extrinsic motivation, predicts higher job exhaustion and disengagement. As expected, based on past studies, the hypotheses for intrinsic motivation (*H1-c, H2-c)* and extrinsic regulation social (*H1-a, H2-a)* were supported. These findings indicate that higher levels of intrinsic motivation predict lower levels of exhaustion and disengagement, and higher levels of extrinsic motivation predict higher exhaustion and disengagement. However, the hypotheses regarding identified regulation (*H1-b, H2-b)* were not supported. Perhaps this is because identified regulation demonstrates short-term effects to protect oneself from burnout (Liu et al., 2019). Identified regulation motivation is at the midpoint of the autonomy continuum and assumes individuals internalize external values to a certain degree. It is possible that a mix of external and internal factors lessens the negative impact of high extrinsic motivation on job burnout. Looking at levels of

Figure 1



autonomy can also help explain the study's findings. Individuals who experience high levels of autonomy tend to thrive more than others and report higher levels of well-being in multiple facets of life (Van Assche et al., 2018). This positive factor seems to help protect individuals from experiencing high levels of job burnout (both disengagement and exhaustion).

The influence of non-clinical depression found in our study provides insight into the importance of mental health at work. Overall, there was a significant influence from intrinsic motivation and mental health, implying that levels of mental health may alter the strength and outcome of types of motivation on efficiency to resist job burnout. We assessed the dimensions of job disengagement and exhaustion to analyze the bigger picture. Regarding hypotheses related to non-clinical depression, results showed mental health moderated the positive influence of intrinsic motivation on job disengagement (hypothesis *H3-a* supported) but not for exhaustion (hypothesis *H3-b* not supported). As predicted, mental health significantly moderates intrinsic motivation and disengagement.

Keyes (2002) demonstrated that positive mental health (e.g., feeling happiness about one's life) is related to a positive outlook on life and engagement in higher productivity at work. On the other hand, poor mental health can worsen the feelings of job burnout. The current study confirms the benefits of intrinsic motivation in resisting job burnout; however, it is not as strong at resisting job disengagement when the complexity of daily stress and sadness has negatively impacted an individual's mental health. Unlike job disengagement, job exhaustion is a consequence of resource scarcity, and mental health did not influence the relationship between intrinsic motivation and job exhaustion.

As with any research, limitations should be noted. One of the biggest concerns is the use of self-reports. Self-reports are an excellent source for personal answers. But they have many risks (e.g., responses may be biased or not be honest). Another limitation worth noting is social desirability, which occurs when participants answer questions to sound more accepted in society. Because this study includes mental health, a sensitive topic, participants may have responded differently to avoid poor mental health results. Finally, future studies need to control extraneous variables more accurately to study the relationship between mental health and job motivation. It is possible that another factor not accounted for in this study, such as existing mental disorders or health concerns, may have been attributed to job burnout. In the future, factoring in other personal aspects like relationship status and personality should also be considered to understand job burnout better. Further research and replication are highly suggested to further the current literature.

The study furthers the literature in this field. It provides significant findings for various types of job motivation and its relationship with mental health concerning job burnout in the wake of changes resulting from a global pandemic. Though job motivation is one of the critical factors in understanding individual differences in job burnout, society should also consider workers' mental health to better understand job burnout in the current dynamic work environment since the start of the COVID-19 pandemic.

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ANALYSIS OF A KILLER: THE PERSONALITY OF H. H. HOLMES

DAVID CROW & WIND GOODFRIEND

BUENA VISTA UNIVERSITY

Abstract – H. H. Holmes is one of the most infamous serial killers in American history. Holmes confessed to killing 27 people and built a "murder castle" to hide his victims. A previous analysis of Holmes argued that childhood traumas influenced his personality and behaviors (Brown et al., 2015). The current paper argues that while childhood can certainly affect adulthood, this is only one potential contributor to adult personality and mental health. We offer four additional factors which may have contributed to Holmes's personality and identity. First, Holmes seems to align with Karen Horney's (1945/1992) idea of moving away from and against people. Next, Holmes's "Big 5" traits are considered (McCrae & John, 1992). Third, the biological approach to personality is applied (Eysenck, 1990). Finally, it is likely Holmes would have been diagnosed with antisocial personality disorder (American Psychiatric Association [APA], 2013). This paper suggests it is only by considering a wide range of possible contributors to personality can we truly understand any individual, including H. H. Holmes and his history of being a con artist, bigamist, and murderer.

Con artist, bigamist, and murderer: These are three verifiable crimes committed by the notorious Henry Holmes (often referred to as H. H. Holmes, 1861-1898), perhaps one of the most prolific serial killers in American history (Brown et al., 2015). Born Herman Webster Mudgett, Holmes grew up in New Hampshire and likely suffered from both abusive parents and bullying in school. While it is speculation, many historians suggest that he may have escaped these traumatic environments by spending time in the nearby woods, where he began killing and dissecting animals (Bailin, 2008). His interest (sometimes called obsession) with physiology, skeletons, and death may have been drivers in his eventual attendance in medical school in Vermont. There, documentation exists that he began a long criminal record by stealing and re-selling corpses and cadavers from labs, graves, and morgues (Brown et al., 2015). He conducted several insurance scams with these cadavers, including the recurring practice of taking out life insurance policies on fictious people, then presenting disfigured cadavers as proof of their death, to cash in (Croyle & Gardiner, 2018). Holmes graduated from medical school in 1884 and changed his name in 1886 (Jenkins, 2019). Throughout his life, Holmes was married to three women at the same time (with none of them being aware of his bigamy) and had several mistresses, many of whom disappeared and are suspected victims of his murders.

After running a drug store for a time, he built a three-story hotel for guests to visit and stay in during the Chicago World's Fair (Brown et al., 2015). Holmes eventually confessed to killing 27 people in the hotel, although some of these people were still alive and may have been part of further insurance scams (Croyle & Gardiner, 2018). He was officially convicted of only one murder, that of friend and fellow con-artist Benjamin Pitezel, and this conviction led to his death by hanging in 1896 (Croyle & Gardiner, 2018). It is believed that Holmes killed several people in the hotel, although it is unclear how many. Various builders, planners, and inspectors of the hotel over the years noted its strange features including secret rooms, acid vats, closets with hidden panels and peepholes, chutes in the walls (perhaps to easily move bodies), and a hidden human-sized cremation oven (Croyle & Gardiner, 2018). The hotel became famously known as the "murder castle," although it was burned down after his conviction (Croyle & Gardiner, 2018).

In a previously published analysis, Brown et al. (2015) argued that Holmes's childhood led to the formation of his personality and behaviors. They wrote, "the determination of the cause for his lust of killing requires some insights into his childhood" (p. 2). The authors then identified several relevant childhood factors such as authoritarian parents who engaged in mental and physical abuse toward Holmes. Brown and colleagues also discuss his early fascination for killing and dissecting

small animals, then progressing to the possible killing of his childhood best friend. While the authors argued that these events affected who he became, they neglected to explain why he was engaging in these behaviors. They concluded, "The H. H. Holmes case exemplifies the connection between childhood trauma and violent crimes, such as multiple homicides" (p. 4).

Brown et al. (2015) make solid arguments, and we do not disagree that his childhood likely influenced him. However, their analysis is limited. Adult personality and behaviors are driven by a wide variety of factors, and childhood experiences is only one of them. Many psychological approaches and theories may provide insight into understanding Holmes's dark personality. In this paper, we argue that a full picture of Holmes can only come from an understanding of additional factors. Specifically, we add to the discussion an analysis of social anxiety, personality traits, biological factors, and personality disorders.

Karen Horney, a critic of Freud's work, believed people develop self-defeating personalities based on their social anxiety (Horney, 1945/1992, 1967). When individuals grow up with inadequate or abusive parents (such as Holmes's), their confusion and need for attention and validation can lead to neurotic behaviors. This neurosis can present itself in three different patterns. First, "moving toward people" is a pattern of desperate longing for love and validation; these people often become co-dependent and find it difficult to end attachments. Second, "moving away from people" is a pattern of isolation; this neurosis typically appears in people who build psychological walls around themselves, never letting others in. Finally, "moving against people" is a pattern in which individuals channel their social anxiety into hostility and aggression toward others.

Holmes appears to display a combination of "moving away from people" and "moving against people." As a child, he avoided his parents and schoolmates due to fear of being abused or bullied (Brown et al., 2015). The emotional and physical abuse he endured may have taught him not to trust others. He may have preferred spending time with animals and cadavers, feeling a sense of control he was unable to find with other living people. While some murders may be the result of passionate anger or jealousy—which would fit into Horney's theory of moving against people—Holmes' murders appeared to be more dispassionate and the result of his obsession with death and making money. He did not avoid relationships altogether—as evidenced by marrying three women simultaneously while also maintaining mistresses—but these relationships appear to have been for convenience rather than due to any emotional attachment (Croyle & Gardiner, 2018). Horney would likely note Holmes's patterns of anger and hostility as moving against people, and his avoidance of genuine relationships as moving away from people.

A more modern approach to understanding personality is the "Big 5" approach, the idea that there are five factors to anyone's personality (McCrae & Costa, 1997, 2008; McCrae & John, 1992). These factors are openness to experience, extraversion, agreeableness, conscientiousness, and neuroticism. Holmes's pattern of behavior indicates being high in openness to experience, as he drifted from one job, city, and spouse to another several times in a relatively short period of time (Croyle & Gardiner, 2018). However, it is unclear whether he genuinely sought these experiences and gained anything from them or simply moved often to avoid paying the consequences of his criminal acts.

Extraversion and agreeableness both relate to interpersonal relations with others (McCrae & Costa, 1997, 2008; McCrae & John, 1992). Holmes appears to have been quite charming and convincing, as documented evidence shows a path of his cons with insurance companies, wives, employers, and the builders of his hotel. While his personality has the appearance of extraversion, his motives were likely cruelty and manipulation, showing a disturbing combination of high extraversion but low agreeableness. He had plans to murder entire families for his own convenience, and may have acted on these plans (Brown et al., 2015).

Holmes may have been high in both neuroticism and conscientiousness (McCrae & Costa, 1997, 2008; McCrae & John, 1992). Neuroticism is a trait relating to anxiety and emotional instability. As noted above, Holmes often isolated himself from society and appeared to act in cruel and malicious ways, often leading to his crimes (Brown et al., 2015). However, he was also probably high in conscientiousness, a trait related to long-term planning and attention to detail. Holmes was exceptionally reliable when it came to his cons and crimes. He had to plan insurance claims and convince others to help him. He also had to be incredibly conscientious when planning his hotel. He built an acid vat and dissection room in the basement of the building ("Murder Castle," 2017). The walls were soundproof. He hid chutes that led to the basement in all the guest bedrooms. He also designed the staircase to be angled sideways, perhaps to make it easier to push people down them. All of this required meticulous planning, including ways to fool the construction worker into doing what he wanted (Croyle & Gardiner, 2018).

It is possible that Holmes' personality was at least partially driven by his biology. The biological

approach to the study of personality suggests that genetics, hormones, and cerebral patterns in the brain drive our thoughts and actions (Eysenck, 1990). This approach suggests that patterns of personality should be relatively consistent over time. Holmes' avoidance of others, lack of empathy, and manipulative tendencies do seem relatively consistent, starting from early childhood (Brown et al., 2015)—this provides support for the biological idea of temperament (e.g., Buss & Plomin, 1984, 1986; Strelau & Zawadzki, 1995). Holmes's patterns of crime, manipulation, and cruelty appeared early in his childhood and continued steadily across all of his stages of life (Croyle & Gardiner, 2018).

Another biological factor in Holmes's personality and behaviors could be brain physiology. While it is speculation, it is possible that some parts of his brain—such as his prefrontal cortex, temporal lobe, white matter volume, and/or amygdala, regions responsible for decision making, impulse control, and emotion regulation—may have been abnormally underdeveloped and associated with his criminal tendencies (e.g., Beckwith et al., 2021). A biological approach also implies that some traits, such as aggression, are heritable and therefore should run in families. His parents were also cold, abusive, and strict, providing case study evidence of the intergenerational cycle of familial abuse (Dunlap et al., 2002; Stith et al., 2000). Several studies have also found intergenerational, biological links to forms of mental illness such as stress responses, low impulse control, and antisocial personality disorder (Buthmann et al., 2018; DeLisi & Vaughn, 2014; Komasi et al., 2022; Trofimova & Christiansen, 2016; Zvereva et al., 2021).

Finally, it is possible that Holmes qualified for at least one personality disorder (American Psychiatric Association [APA], 2013). The most likely diagnosis appears to be antisocial personality disorder, which is associated with consistent disregard for others' rights, deceitful and aggressive behaviors, lack of empathy, harm toward others in childhood, and the appearance of charm to others. Studies have linked antisocial personality disorder with serial murder, narcissism, and sexual sadism, all which appear to have been salient features of Holmes's personality (Geberth & Turco, 1997; LaBrode, 2007). Antisocial personality disorder can be the result of an abusive and traumatic childhood (Simons, 2001) and is often the diagnosis later given to children who showed juvenile delinquency, such as Holmes (Holmes et al., 2001).

Holmes showed many of these diagnostic criteria. Holmes generally avoided people unless he could use them for some selfish purpose (Brown et al., 2015). He apparently killed several animals as a child and showed little empathy. He may have killed his best friend when he was a young adult; it is unclear whether the friend fell off a landing or whether Holmes pushed him. He likely murdered several people for insurance claims (Croyle & Gardiner, 2018).

Despite these qualities, Holmes also had some interpersonal charm (another sign of antisocial personality disorder). He married his first wife at a young age and had a son, but he abandoned them after an early insurance scam (Brown et al., 2015). He later married at least two additional women—in different cities, all at the same time, without them having any knowledge of each other. He convinced many people to do many things over his life, apparently being a master manipulator. This manipulation and outward charm are additional symptoms of antisocial personality disorder (APA, 2013) and of interpersonal violence toward family members (Dutton, 1998; Holtzworth-Munroe & Stuart, 1994).

H. H. Holmes' personality was multi-faceted. While Brown et al. (2015) offer insight regarding how his childhood traumas may have influenced the person he became, we argue that a full understanding and profile of Holmes must take into account additional factors. We identified four here: social anxiety, personality traits, biological factors, and personality disorders. Holmes was a survivor of abuse who unfortunately appears to have continued this cycle of violence in adulthood, killing a still-unknown number of people. That said, his background, personality, and possible mental health disorders are only some of things that made up his complete self. His long list of cons, abuses, murders, and marriages show that for at least some criminals, they are adept at hiding their true personality behind a mask. While any analysis of his behaviors and personality are speculation at this point, understanding his life is enhanced by the application of psychological theory.

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Author Note

Correspondence may be addressed to: Wind Goodfriend, Ph.D., Psychology Department, 610 W. 4th Street, Buena Vista University, Storm Lake, IA 50588, Email goodfriend@bvu.edu, Fax 712-749-2037.

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THE TRAGEDY OF MEDUSA:
A PSYCHOLOGICAL ANALYSIS OF BEHAVIOR

EMILY NIX & WIND GOODFRIEND

BUENA VISTA UNIVERSITY

Abstract – Medusa—the snake-haired villain in Greek mythology—may be well known but little understood. Her behavior is analyzed using four theoretical perspectives: classical conditioning, self-fulfilling prophecies, environment vs. personality, and self-discrepancy theory. Medusa endured constant attacks from men, potentially classically conditioning her to hate and fear them. Medusa's behaviors can also be explained by a self-fulfilling prophecy, where people treating her as a monster seems to turn her into one. After enduring a curse and social ostracism, she may act in ways driven more by her situation than by her true nature. Finally, she may have three separate selves: who society believes she is, who she actually is, and who she wants to be. Medusa's story ends in tragedy, as do most stories for those perceived as villains by the outside world—but a psychological analysis provides insight into her side of the story.

When people think of monsters, they typically think of large scary creatures that induce nightmares in even the bravest individuals—and that is the perception that most people have of Medusa. Many people are familiar with her basic image: A woman with snakes for hair who can turn people to stone with a look. However, her character was not always so petrifying in nature. How she is portrayed and perceived has changed over time, leading to an interesting opportunity for a psychological analysis.

In this paper, Medusa's behaviors and persona will be evaluated using classical conditioning (McLeod, 1970; Pavlov, 1927), self-fulfilling prophecies (Schaedig, 2020; Snyder, 2001), Mischel's (1979; Mischel & Shoda, 1995) idea that behavior is predicted more by one's environment over one's personality, and self-discrepancy theory (Higgins, 1987, 2008). Each psychological concept reveals how people formed the impression of Medusa as a monster—an image she may not deserve. Before the psychological analysis, a brief foundation of the Medusa myth and the cultural contexts in which it was popular is warranted.

Cultural Background

The mythology surrounding Medusa has multiple versions. The original story was written in ancient Greek culture and then modified by ancient Romans, like many other Greek mythological figures. The original Greek version of Medusa cast her in the role of a Gorgon, one of three monstrous sisters; she was not a human woman who might have been deserving of pity or empathy (Wilk, 2000). In this original version, she was a villain from the beginning. This characterization of her may reflect the misogyny of the era. During the time in which the Medusa myth was created in Greece, women were viewed as less than men, relegated to only two acceptable roles: wives and mothers (Cole, 1984). Women had few legal rights, especially if they were not in the upper socioeconomic class. Acts of sexual violence were at best excused and ignored, or at worst used to blame the survivors for crimes like adultery. This victim blaming led to women being stigmatized and politically helpless (Cole, 1984).

With the continuation of her story into Roman mythology, Medusa changes in appearance and receives more of an origin story. Most of these later versions agree that Medusa was the daughter of Phorcys, a sea god, and Ceto, a goddess of sea monsters (Nagy, 2020). In Roman versions, she was born mortal. Medusa started her journey as a devout priestess of the goddess of war, Athena, including a vow of celibacy. Poseidon, the main god of the sea, spotted Medusa and admired her beauty, including long, curly, golden hair. Poseidon decided that he must have Medusa because of her beauty, and perhaps also to spite Athena by taking away Medusa's virginity.

The sea god then forced himself upon Medusa at the temple of Athena, leaving Medusa to deal with the consequences. When Athena found out, she cursed Medusa with snakes for hair, a stony gaze, and a hideous appearance. Shamed, Medusa then resided far from society. Instead of leaving her with her grief, multiple heroes of mythology hunted her with the hope of taking her head as a prize. The vicious tale ends with Perseus finally defeating the cursed Medusa.

Roman culture regarded rape and sexual assault in a similar way to that of the Greeks, typically blaming survivors—especially when the perpetrator was of higher status (Nguyen, 2006). This fits with Medusa's assault; she was tossed aside and condemned because she was ranked lower than Poseidon. While Medusa was not condemned in a court of law, Athena acted as the judge and jury, punishing her for a crime that Medusa did not commit. Medusa is cursed and banished to a life of isolation, now with the famous snakes and stony gaze.

The popularity of Medusa's story has endured over centuries. With the idea of the "femme fatale" trope rising in the 19th century, we saw this resurgence of her story with modern twists, such as being further sexualized—but still a villain (Cain, 2018). Over the years, Medusa is generally considered a woman who is beautiful but dangerous, often with her beauty being her downfall. A modern interpretation from a feminist lens could emphasize how these aspects of the story incorporate victim blaming for sexual assault (Acock & Ireland, 1983; Smith, 2022; Van der Bruggen & Grubb, 2014) and societal backlash for empowered women (Goh et al., 2022; Rudman & Glick, 2001). While versions of her story have varied over time, this paper focuses on the classic Roman version and these feminist implications, using four theoretical perspectives from psychology.

Psychological Analysis

Classical Conditioning

Classical conditioning (McLeod, 1970; Pavlov, 1927) may not seem to have an obvious connection to this tragedy. Classical conditioning occurs when we respond to a conditioned stimulus in the environment because it serves as a cue for an unconditioned stimulus, usually after repeated pairings. The unconditioned stimulus is one we react to on an instinctive level. Classical conditioning is particularly powerful when our initial response is one of fear, likely due to evolutionary instincts based on survival leading to biological predispositions (Pinker, 1994). Because of her poignant fate, Medusa is conditioned to hate and fear men.

Medusa associates men with trauma. The cursed maiden was first attacked by Poseidon; that encounter ended with a very traumatic experience. She was then subjected to years of fighting for her life as man after man came to attack her. Medusa would have been terrified of a man getting too close because of the severity of the curse that she received from Athena after Poseidon robbed her of her virginity. This repetitive situation (i.e., multiple pairings of men and trauma) caused a change in Medusa. Her original personality—a loyal and kind-hearted priestess of Athena—morphed into to a horrifying creature killing the supposed "heroes" of Greece. Just like Pavlov's dogs salivating at the sound of a metronome, Medusa was conditioned to kill any man on sight because she was so accustomed to men only coming to hurt her. Her instinctive, conditioned response is fear, and she responded by fighting for her life.

Self-Fulfilling Prophecies

Self-fulfilling prophecies might also provide insight into Medusa's story. Another Greek myth suggested that a shy sculptor named Pygmalian created a beautiful woman made out of stone who was later brought to life by Aphrodite. This myth is the origin of the Pygmalian effect, sometimes called self-fulfilling prophecies. The psychological phenomenon occurs when our expectations of people cause their behavior to change, making those predictions come true (Merton, 1948; Schaedig, 2020; Snyder, 2001). Self-fulfilling prophecies can predict whether employees will do well or badly (Eden, 1990; Glover et al., 2017), whether students will fulfill good or bad expectatiosn from teachers (Rosenthal, 1994), and how social stigmas may disadvantage groups (Jussim & Harber, 2005).

Medusa's fate may have been somewhat shaped by self-fulfilling prophecies when she was blamed for everything that happened to her. While she had no choice in Poseidon's attack or Athena's curse, people decided she was worthy of attack and justified their actions against her (Crandall & Eshleman, 2003). Once people perceived her as a monster, she tried to flee from others and live in isolation—but as male "heroes" decided to hunt her, she was forced to act in the monstrous ways everyone expected. Medusa's identity changed because of the labels and expectations put on her by others, finally accepting their prophecies for herself.

Environment versus Personality

How much of behavior is due to inherent personality, and how much is due to our life circumstances? Several social psychologists have suggested that while behavior is often assumed to be driven by individual differences or personality, it is often really the result of situational demands—a mistake called the fundamental attribution error (Gilbert & Malone, 1995; Heider, 1958). Famously, Mischel argued that personality really has little to do with our actions and that

personality can change over time, especially after traumatic events (Mischel, 1979; Mischel & Shoda, 1995).

Medusa's main life events (the assault and subsequent curse) were out of her control—but instrumental in changing who she became. Medusa started out as such a pure and kind maiden until the situation changed. She then became a terrifying creature, betrayed by her mentor (Athena) and forced to kill to survive. These drastic circumstances made her into the monster she became. She likely would have continued to serve Athena had the goddess been more lenient and understanding. This possibility adds a new depth to the traditional interpretation of the evil Gorgon: Should we judge Medusa for who she became, or for who she wanted to be? This question leads to the final theoretical perspective discussed in this paper.

Self-Discrepancy Theory

Self-discrepancy theory (Higgins, 1987, 2008) emphasizes that we all grow and change over life, balancing our self-concept within three different selves. Our "actual" self is who we are right now. Our "ideal" self is who we personally want to be. Finally, our "ought" self is the person other people in our life want us to be, or the labels and judgments which are forced upon us by others. The theory also notes that when these three selves don't align we will feel negative emotions. Specifically, when the actual self doesn't live up to our ideal self we will feel "dejection" emotions such as shame and embarrassment. When our actual self doesn't match our ought self we will feel "agitation" emotions such as fear and guilt.

Medusa's personal journey is one of change, culminating when she seems to accept her fate as a monster. At the beginning, Medusa was a normal human girl whose only desire was to be the best priestess of Athena; that was her ideal self. She seemed to be accomplishing that, moving toward alignment between her actual and ideal self. Medusa was then ripped away from her ideal self. After her assault and curse, Medusa's actual self became a creature that could only be identified as a monster. Others blamed her and judged her, then hunt her—and this monster identity became her ought and actual self. It is likely that she felt both the "dejection" and "agitation" that Higgins's theory predicts, trapped in a self she never wanted.

Conclusion

Medusa's story is a tragedy of victim blaming and lack of empathy regarding a young woman who was a plaything of petty gods. Medusa may have perceived that her only recourse was to become the best monster she could be. She eventually embraced a life of destroying men and anyone else who dared to cross her. Tired of constant attacks, disappointment in those she loved, and invaders of her home, she embraced the empowered persona of a heartless and terrifying being. Medusa's three selves aligned, although in a potentially heartbreaking way.

A modern, feminist view of Medusa may be that she is much more than a monster. She was a paragon of virtue and virginity in ancient Rome but still ended up cursed and villainized.

Medusa became a plaything to the gods, tossed aside when they grew tired of her. She did what she could to become empowered as the "monster" everyone expected her to be. Medusa could be considered a representation of the traumas some modern women experience. While she did not survive her ordeals, her persistence is symbolic for modern women.

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Author Note

Correspondence may be addressed to: Wind Goodfriend, Ph.D., Psychology Department, 610 W. 4th Street, Buena Vista University, Storm Lake, IA 50588, Email goodfriend@bvu.edu, Fax 712-749-2037.

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